Welcome to the Microcredential DTAN Course!

Welcome to the microcredential course on Data and Analysis! We are using the abbreviation DTAN to differentiate this course from the others, so you will see that acronym used throughout the course.

This microcredential course is formatted into three sections:

- Course Materials, comprised of Learning Modules containing content and resources for competencies that are aligned with the Virginia Computer Science SOLs and mini-assessments to prepare you for the final course assessment
- Lesson Plan Assignment, including resources and templates for developing your lesson plan for the course
- Final Assessment, which - combined with the Lesson Plan you will submit - will demonstrate your mastery of the content for this course

To maximize development of your computer science pedagogical content knowledge, we recommend that you step through each module in the order presented. **Access the Course Materials, Lesson Plan Assignment, and Final Assessment sections using the menu to the left.**

Once you have completed each of the learning modules for this course, you will complete the Lesson Plan Assignment and the Final Assessment (order of completion of those is your choice).

Here is what to do:

- Click sequentially through the modules in Course Materials and view the material.
- Complete the quiz at the end of each module to test your knowledge ahead of the final assessment.
- Complete the Final Assessment for the course.
- Upload a lesson plan to finish the microcredential.

If you need assistance at any time, please email TCEP@odu.edu.

DTAN Teacher Competency 1. Identify different types of data that can be collected.

This teacher competency is aligned with the following Computer Science SOLs:

- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 4.14. The student will use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB).
- CS 5.13. The student will use numeric values to represent non-numeric ideas in the computer (e.g., binary, ASCII, pixel attributes such as RGB).

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.
*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

DTAN 1 - What is data.pdf (https://canvas.odu.edu/courses/185318/files/44847179/download?wrap=1)
⤓ **(https://canvas.odu.edu/courses/185318/files/44847179/download?download_frd=1)** Ⓐ

When hearing **"DATA"**, you may imagine `sophisticated` `scientists` working at a **BIG TECH** company...

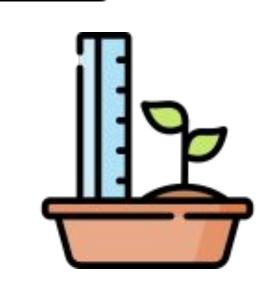BUT DATA IS **SIMPLE, BROAD,** AND **EASY TO LEARN!**

Data: information

OR statistics
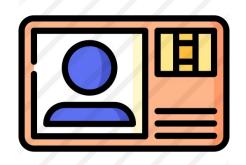
collected through

observation.

It's that simple!

We **collect** data **every second** of **every day** without realizing it!

Data comes in **different types**…
not all of them are `numbers`!

In fact, some are
NUMBERS
representing
NON-NUMERIC ideas
(Think: phone numbers, SSN, etc.)
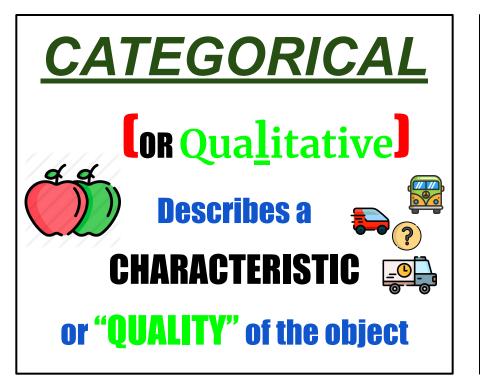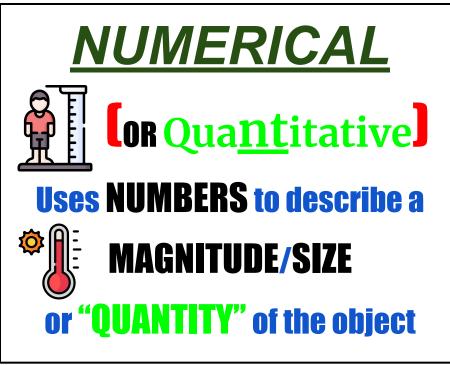
THE **TWO** MAIN TYPES OF DATA

CATEGORICAL

[OR Qual<u>i</u>tative**]**

Describes a

CHARACTERISTIC

or "**QUALITY**" of the object

NUMERICAL

[OR Qua<u>nt</u>itative**]**

Uses **NUMBERS** to describe a

MAGNITUDE/SIZE

or "**QUANTITY**" of the object

TWO TYPES OF *CATEGORICAL* DATA

ORDINAL

Can be ORDERED or RANKED

(Think: Rating, Age Group, Education Level, Clothing Size, etc.)

NOMINAL

Gives a NAME or LABEL

(Think: Name, Date, GPS Location, Shape, Country, Smell, Text, Images, etc.)

TWO TYPES OF *NUMERICAL* DATA

DISCRETE

For COUNTABLE items

(Think: Population Count, Shoe Size, Richter Scale, Credit Score, etc.)

CONTINUOUS

Represents MEASUREMENT

(Think: Weight, Height, Temperature, Time, Speed, Percentage, etc.)
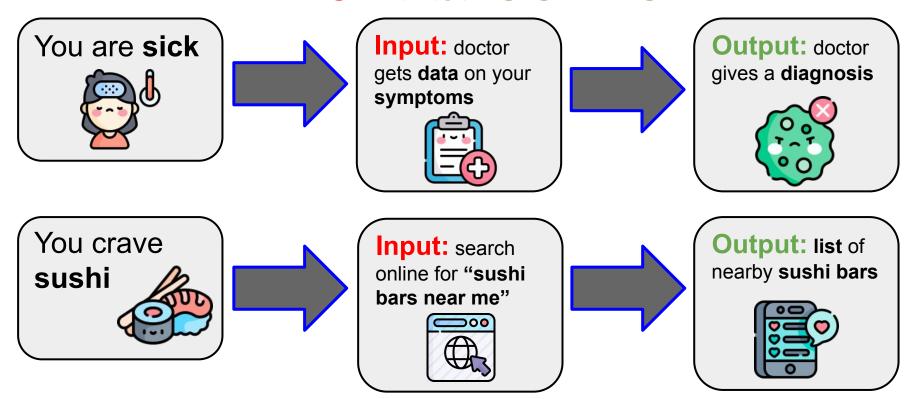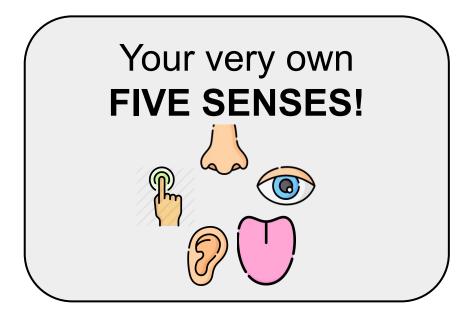
Data can act as

INPUT and/or OUTPUT

You are **sick**

Input: doctor gets **data** on your **symptoms**

Output: doctor gives a **diagnosis**

You crave **sushi**

Input: search online for **"sushi bars near me"**

Output: **list** of nearby **sushi bars**
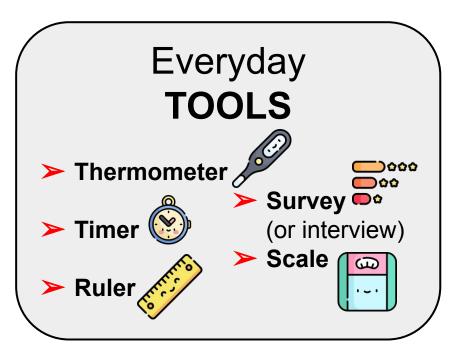
How is Data **COLLECTED**

Without TECHNOLOGY**?**

Your very own
FIVE SENSES!

Everyday
TOOLS

➤ **Thermometer**

➤ **Survey**
(or interview)

➤ **Timer**

➤ **Scale**

➤ **Ruler**

TECHNOLOGY

Has **REVOLUTIONIZED** Data Collection

SENSORS have the ability to **COLLECT** data with **LOW ERROR** at a *VERY RAPID PACE*, with computers able to STORE and GENERATE LARGE AMOUNTS OF DATA

DTAN Teacher Competency 1. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competency 1. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 1.pdf (https://canvas.odu.edu/courses/185318/files/44846670/download?wrap=1) ↓ (https://canvas.odu.edu/courses/185318/files/44846670/download?download_frd=1)

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Introduction	Proficient	Proficient	Proficient	Proficient	Proficient
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Introduction	Proficient	Proficient	Proficient	Proficient
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Introduction	Proficient	Proficient	Proficient
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Introduction	Proficient	Proficient	Proficient
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Introduction	Introduction	Proficient
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Introduction	Introduction	Proficient
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Introduction	Introduction

Light blue – Introduction   Dark blue - Proficient

DTAN Teacher Competency 1. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
1.11 The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 1.12a (collect and organize data using various forms of data collection and represent data in tables, picture graphs, and object graphs) Science: 1.1c (organize and represent various forms of data using tables, picture graphs, and object graphs)
2.11 The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 2.15a (collecting, organizing, and representing data in pictographs and bar charts) Science: 2.1c (organize and represent data in pictographs and bar graphs)
5.13 The student will use numeric values to represent non-numeric ideas in the computer (e.g., binary, ASCII, pixel attributes such as RGB).	Mathematics: 5.19a (describing a variable as a representation of an unknown quantity)

DTAN Teacher Competency 1. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

- **Categorical vs Numerical Data: 15 Key Differences & Similarities (formpl.us)** ⤷ **(https://www.formpl.us/blog/categorical-numerical-data)**

- **Difference Between Categorical Data and Numerical Data | Compare the Difference Between Similar Terms** ⤷ **(https://www.differencebetween.com/difference-between-categorical-data-and-vs-numerical-data/)**

DTAN Teacher Competency 2. Collect data based on defined categories.

This teacher competency is aligned with the following Computer Science SOLs:

- CS K.4. The student will categorize a group of items based on one attribute or the action of each item, with or without a computing device.
- CS K.9. The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.
- CS 1.5. The student will categorize a group of items based on one or two attributes or the actions of each item, with or without a computing device.
- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 3.5. The student will compare and contrast a group of items based on attributes or actions classified into at least two sets and two subsets.
- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.
*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

DTAN 2 - Grouping by attributes.pdf
(https://canvas.odu.edu/courses/185318/files/44846671/download?wrap=1) ⤓
(https://canvas.odu.edu/courses/185318/files/44846671/download?download_frd=1) 🧑

GROUPING

By Attributes

An ATTRIBUTE* is a QUALITY or CHARACTERISTIC. It can be collected as DATA

* Also known as a PROPERTY

Common Attributes of Everyday Objects:

Color

Smell

Shape

Author

Size

Date
Birth, expiration, etc.

Weight

Origin

Let's COMPARE attributes...

Power: Gas Engine

# of wheels: 4

# of doors: 4

Weight: 2500 pounds

Think of **other** attributes you could **compare!**

Power: Human

# of wheels: 2

# of doors: 0

Weight: 80 pounds

GROUPING OBJECTS BY THEIR ATTRIBUTES SERVES COUNTLESS PURPOSES IN THE REAL WORLD...

Grouping types of **groceries** into their own **aisles** makes shopping much easier and faster.

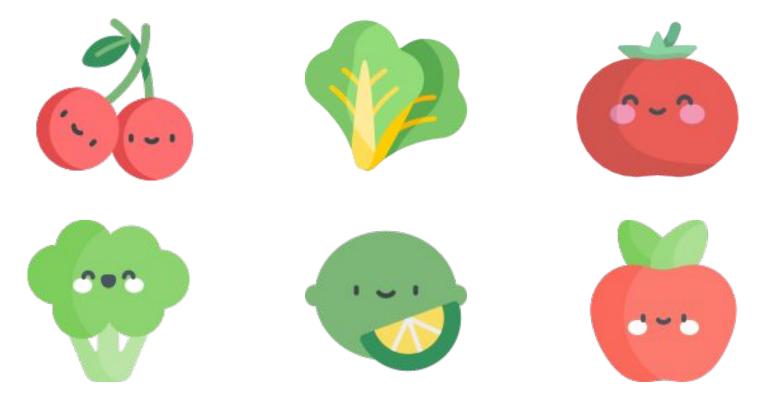Grouping **clothing** by the washing water **temperature** and **color** prevents colors from mixing.
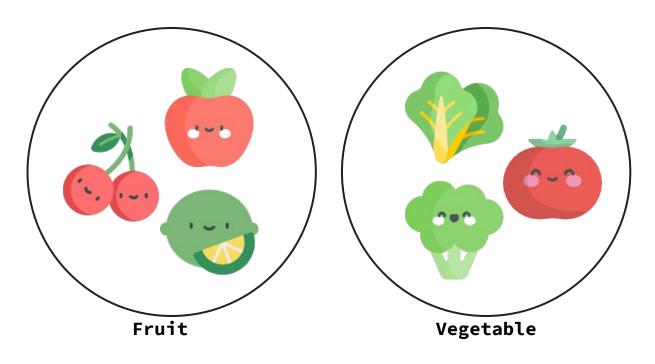
Grouping the same type of **assignment** in a **gradebook** helps with solving a weighted average.

Say we wanted to group this PRODUCE.
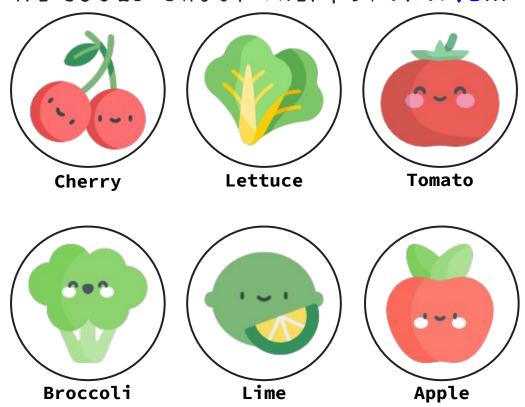
WE CAN GROUP THEM INTO FRUITS AND VEGETABLES*

AND FORM TWO GROUPS OF THREE TYPES OF PRODUCE EACH.

Fruit

Vegetable
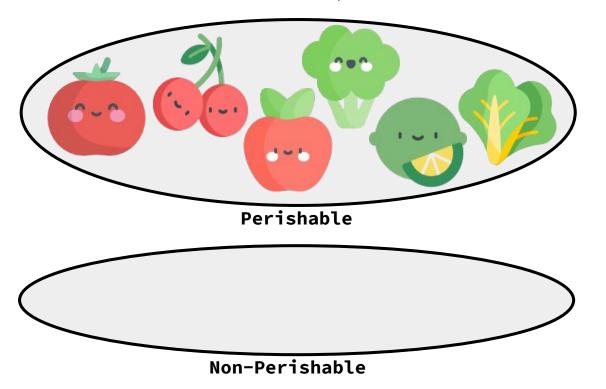
*Tomatoes are vegetables for this example

We **COULD** GROUP THEM BY NAME...

Cherry

Lettuce

Tomato

Broccoli

Lime

Apple
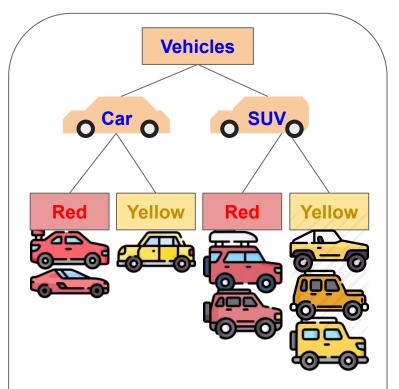
... BUT WE HAVE ALL GROUPS OF ONE, WHICH ISN'T VERY USEFUL.

We **could** group them by PERISHABILITY...

Perishable

Non-Perishable

... BUT ALL THE PRODUCE FALLS INTO A SINGLE GROUP, WHICH DOESN'T HELP WITH SEPARATING.

A set of objects can be grouped by MULTIPLE ATTRIBUTES, but the grouping MUST be done ONE ATTRIBUTE AT A TIME!
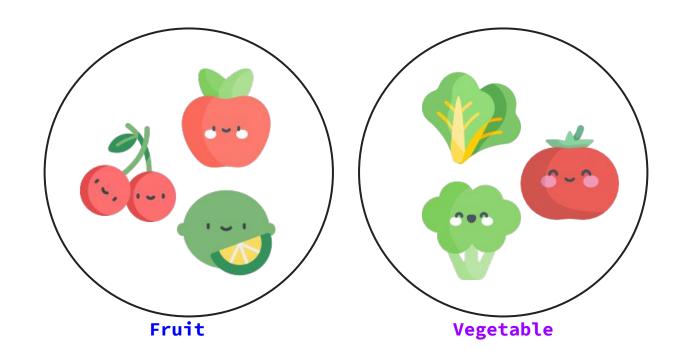
Here, vehicles are grouped FIRST by TYPE THEN by COLOR.
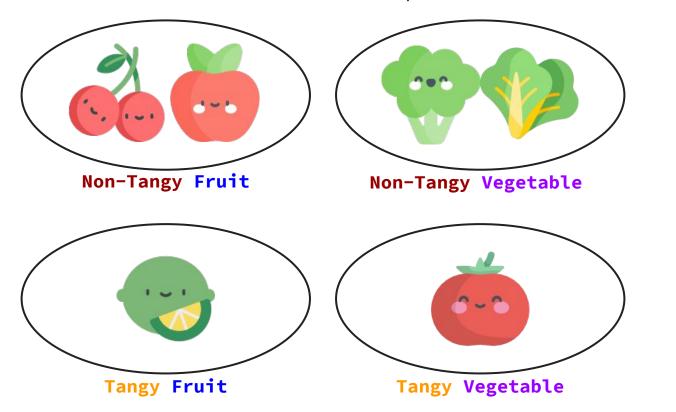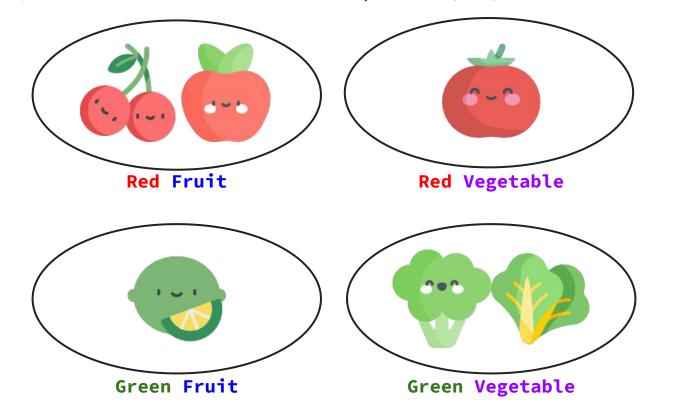
Looking at the grouping of FRUITS and VEGETABLES...

Fruit

Vegetable
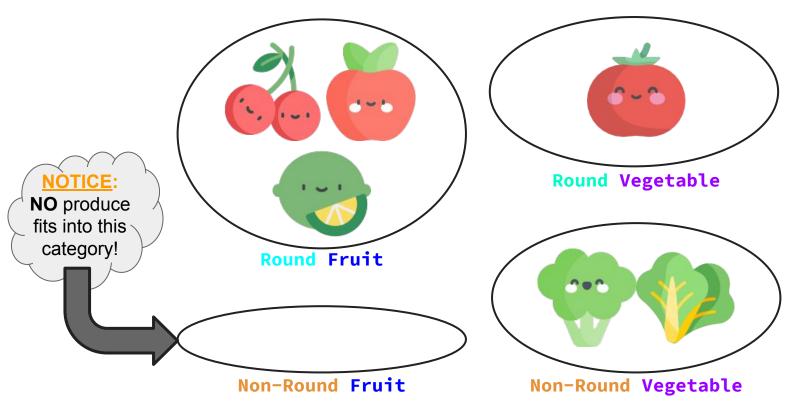
...OR FURTHER GROUP THEM BY COLOR INSTEAD...

Red Fruit

Red Vegetable

Green Fruit

Green Vegetable

Theses groupings were done by splitting a group into TWO groups, but this can be done with AS MANY GROUPS AS NEEDED to properly CATEGORIZE objects!

DTAN Teacher Competency 2. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competency 2. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 2.pdf **(https://canvas.odu.edu/courses/185318/files/44846672/download?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846672/download?download_frd=1)**

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Introduction	Proficient	Proficient	Proficient	Proficient	Proficient
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Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Introduction	Proficient	Proficient	Proficient
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Introduction	Proficient	Proficient	Proficient
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Introduction	Introduction	Proficient
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Introduction	Introduction	Proficient
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Introduction	Introduction

Light blue – Introduction   Dark blue - Proficient

DTAN Teacher Competency 2. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
K.4 The student will categorize a group of items based on one attribute or the action of each item, with or without a computing device.	English: K.7 (use adjectives to describe attributes) Mathematics: K.9 (comparing attributes); K.12 (sort and classify) Science: K.3 (physical properties); K.6 (senses); K.6 (classifying living and nonliving) Social Studies: K.1 (classify information); K.3 (physical properties); K.4 (describe locations using positional words)
K.9 The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.	Mathematics: K.11 (data collection and interpretation) Science: K.1 (across all science standards)
1.5 The student will categorize a group of items based on one or two attributes or the actions of each item, with or without a computing device.	English: 1.7c (sorting words into categories, defining words by attributes) Mathematics: 1.13 (sort and classify concrete objects into appropriate subsets (categories) based on one or two attributes) Science: 1.1c (classify objects); 1.3a (classify objects based on physical properties and explain how the objects were classified); 1.4c (plants can be classified); 1.5c (animals can be classified)
1.11 The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 1.12a (collect and organize data using various forms of data collection and represent data in tables, picture graphs, and object graphs) Science: 1.1c (organize and represent various forms of data using tables, picture graphs, and object graphs)
2.11 The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 2.15a (collecting, organizing, and representing data in pictographs and bar charts) Science: 2.1c (organize and represent data in pictographs and bar graphs)
3.5 The student will compare and contrast a group of items based on attributes or actions classified into at least two sets and two subsets.	English: 3.4 (identifying and classify words based on characteristics)

Computer Science Standard	Opportunity for Integration
	Mathematics: 3.12b (classifying polygons by their attributes) Science: 3.5a (classifying components of an ecosystem) Social Studies: 3.1e (classifying ancient cultures by their attributes)
3.12 The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.	Mathematics: 3.15 (collecting, organizing and interpreting data in pictograph and bar graph) Science: 3.1c (analyzing data in pictograph and bar graph); 3.1d (use evidence to support a construct or support an explanation) Social Studies: 3.1c (survey family members to determine ways they help their community, country, and world and create a web or a simple bar graph to show the results)
4.12 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	English: 4.5 (reading to draw conclusions); 4.7 (writing to make predictions) Mathematics: 4.14 (collecting, organizing, representing, and interpreting data in bar and line graphs) Science: 4.1a (develop hypothesis as cause and effect relations); 4.1c (interpreting, analyzing, and evaluating data)
5.11 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	Mathematics: 5.16 (represent data in a number of forms); 5.17 (describing data) Science: 5.1a (predict reasonable outcomes based on patterns); 5.1c (using tables and graphs to organize and analyze data); 5.1d (constructing and critiquing conclusions and explanations) Social Studies: VS.1c (interpreting charts and graphs to glean information)

DTAN Teacher Competency 2. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

[Sort the Same Group Two Different Ways | Preschool and Kindergarten | Kids Academy - Bing video ⇲ (https://www.bing.com/videos/search?q=how+to+group+your+data+kids&docid=608014245026796838&mid=8DA8E16A113E997A2CD78DA8E16A113E997A2CD7&view=detail&FORM=VIRE)](https://www.bing.com/videos/search?q=how+to+group+your+data+kids&docid=608014245026796838&mid=8DA8E16A113E997A2CD78DA8E16A113E997A2CD7&view=detail&FORM=VIRE)

DTAN Module 1 Quiz

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment for this course.
You can take the quiz up to three times.

Quiz Type	Graded Quiz
Points	70
Assignment Group	Imported Assignments
Shuffle Answers	No
Time Limit	No Time Limit
Multiple Attempts	Yes
Score to Keep	
Attempts	3
View Responses	Always
Show Correct Answers	Immediately
One Question at a Time	No
Require Respondus LockDown Browser	No
Required to View Quiz Results	No

Due	For	Available from	Until
-	Everyone	-	-

Preview

DTAN Module 1 Quiz

⚠ This is a preview of the published version of the quiz

Started: Sep 20 at 9:31am

Quiz Instructions

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment for this course.
You can take the quiz up to three times.

⠿

Question 1 10 pts

Qualitative data consists of numbers and concepts that can be counted.

○ True

○ False

⠿

Question 2 10 pts

What is an advantage of entering data by hand over using a tool such as a sensor to collect data?

☐ Less likely to have user input error

☐ Easier to generate large amounts of data

☐ Can double check for validity as data in entered

☐ Familiarity with data as it is input increases the understand of any trends

⠿

Question 3 10 pts

What types of information can be "data"?

○ Search history

○ Songs

○ Images

○
All of the above

⠿

Question 4 10 pts

Which of the following are NOT methods for data collection?

○
Polls

○
Sensors

○
Histograms

○
Interviews

⠿

Question 5 10 pts

It is easier to encounter human error when entering data by hand.

○
True

○
False

⠿

Question 6 10 pts

Check all attributes that are typically used when grouping data points.

☐
Color

☐
Author

☐
File type

☐
Date

⠿

Question 7 10 pts

How many factors can data be sorted by?

○
One

○
Two

○

It can't

○

As many factors as desired

Not saved   Submit Quiz

Data and Analysis Module 2

When you complete this learning module, you should be able to:

- **Represent** gathered data in tables.
- **Manipulate** data sets in order to clean and process for analysis.
- **Create** visualizations based on the data represented.

DTAN Teacher Competency 3. Represent gathered data in tables.

This teacher competency is aligned with the following Computer Science SOLs:

- CS K.9. The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.
- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

DTAN 3- Data representation.pdf **(https://canvas.odu.edu/courses/185318/files/44846673/download?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846673/download?download_frd=1)**

Representing Data in

TABLES

Now that you've collected your data,

THE NEXT STEP IS

organizing it.

This is done using TABLES!

Making A Table Is Easy!
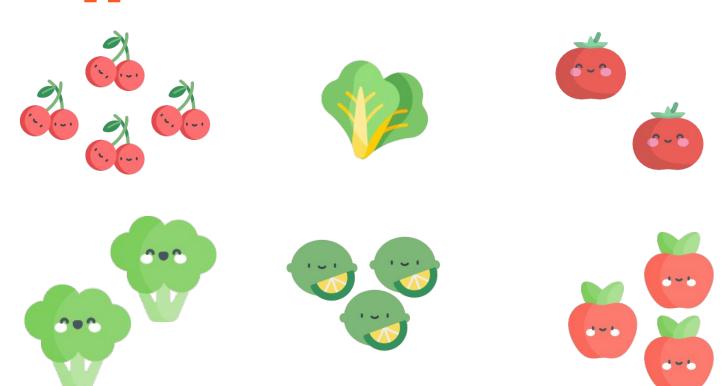
Each **COLUMN** is an **attribute** data was collected *on*.

Name	Age	Eye Color	Favorite Food
John Smith	7	Brown	Pizza
Abdallah Yusuf	6	Hazel	Spaghetti
Sandra Lopez	8	Blue	Chicken Nuggets

Each **ROW** is an **object** data was collected *from*.

Each **BLOCK** is a **value** of the attribute in the same column for the object in the same row.

Suppose we had some PRODUCE...
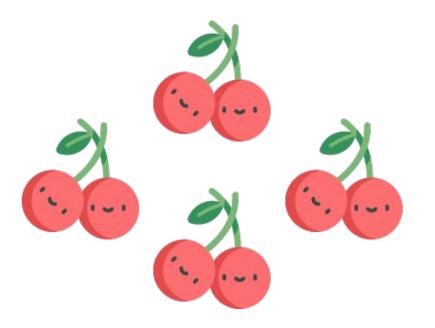
First, Let's Pick Out Some Attributes

An object may have COUNTLESS attributes,
usually picked out for collecting data to meet a CERTAIN GOAL.

Here, we will collect data on color, texture,
type (fruit or vegetable), and amount.

Attributes of the **Cherries**

Color: *red*

Texture: *smooth*

Type: *fruit*

Amount: *4*

Attributes of the Broccoli

Color: *green*

Texture: ROUGH

Type: *vegetable*

Amount: 2

We have **FOUR** other groups of produce....

... but you got the idea.

Let's **Create** the **Table**

The *FIRST STEP* is to create

the attribute **COLUMNS**

There will be no data added... **YET**.

Name	Image	Color	Texture	Type	Amount

Finally, let's populate the table with our produce DATA
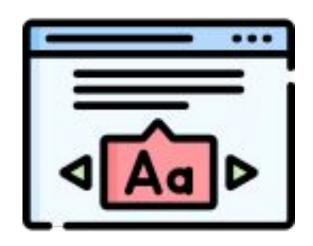
Name	Image	Color	Texture	Type	Amount
cherry		red	smooth	fruit	4
lettuce		green	ROUGH	vegetable	1
tomato		red	smooth	vegetable	2
broccoli		green	ROUGH	vegetable	2
lime		green	ROUGH	fruit	3
apple		red	smooth	fruit	3
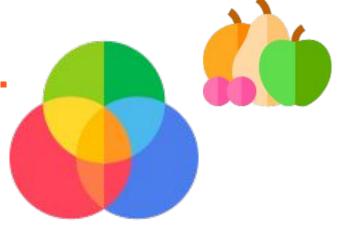
NOTICE how there were many different **TYPES** of **DATA** in our table...

Tables aren't **ONLY** for representing data... 🤔

... rows can be *REARRANGED*!

What's the purpose of that, you ask?

We can **SORT** the rows

by different **ATTRIBUTES**,

making it **easier** to find *patterns*!

Common **SORTING** schemes:

→ C̲h̲r̲o̲n̲o̲l̲o̲g̲i̲c̲a̲l̲

latest to **earliest** OR *vice versa*

➤ **A**lpha**B**eti**C**al

A to **Z** OR *vice versa*

▼. N̲u̲m̲e̲r̲i̲c̲a̲l̲

smallest to **largest** OR *vice versa*

Let's SORT our produce by COLOR

Name	Image	Color	Texture	Type	Amount
cherry		red	smooth	fruit	4
tomato		red	smooth	vegetable	2
apple		red	smooth	fruit	3
broccoli		green	ROUGH	vegetable	2
lime		green	ROUGH	fruit	3
lettuce		green	ROUGH	vegetable	1

Notice: our red produce is ALL smooth,
while our green produce is ALL ROUGH!

What if we SORT our produce by TYPE?

Name	Image	Color	Texture	Type	Amount
cherry		red	smooth	fruit	4
apple		red	smooth	fruit	3
lime		green	ROUGH	fruit	3
broccoli		green	ROUGH	vegetable	2
tomato		red	smooth	vegetable	2
lettuce		green	ROUGH	vegetable	1

Notice: we have **MORE** of each *fruit*, than we have of each **vegetable**!

TABLES ARE A GOOD TOOL FOR ANALYZING THE DATASET FOR PATTERNS AND OBSERVATIONS, AND WE'RE YET TO CREATE A GRAPH OR VISUALIZATION!

DTAN Teacher Competency 3. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competency 3. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 3.pdf **(https://canvas.odu.edu/courses/185318/files/44846674/download?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846674/download?download_frd=1)**

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Light	Dark	Dark	Dark	Dark	Dark
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Light	Dark	Dark	Dark	Dark
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Light	Dark	Dark	Dark
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Light	Dark	Dark	Dark
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Light	Light	Dark
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Light	Light	Dark
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Light	Light
Light blue – Introduction Dark blue - Proficient						

DTAN Teacher Competency 3. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
K.9 The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.	Mathematics: K.11 (data collection and interpretation) Science: K.1 (across all science standards)
1.11 The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 1.12a (collect and organize data using various forms of data collection and represent data in tables, picture graphs, and object graphs) Science: 1.1c (organize and represent various forms of data using tables, picture graphs, and object graphs)
2.11 The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 2.15a (collecting, organizing, and representing data in pictographs and bar charts) Science: 2.1c (organize and represent data in pictographs and bar graphs)
3.12 The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.	Mathematics: 3.15 (collecting, organizing and interpreting data in pictograph and bar graph) Science: 3.1c (analyzing data in pictograph and bar graph); 3.1d (use evidence to support a construct or support an explanation) Social Studies: 3.1c (survey family members to determine ways they help their community, country, and world and create a web or a simple bar graph to show the results)
4.12 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	English: 4.5 (reading to draw conclusions); 4.7 (writing to make predictions) Mathematics: 4.14 (collecting, organizing, representing, and interpreting data in bar and line graphs) Science: 4.1a (develop hypothesis as cause and effect relations); 4.1c (interpreting, analyzing, and evaluating data)
5.11 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	Mathematics: 5.16 (represent data in a number of forms); 5.17 (describing data) Science: 5.1a (predict reasonable outcomes based on patterns); 5.1c (using tables and graphs to

Computer Science Standard	Opportunity for Integration
	organize and analyze data); 5.1d (constructing and critiquing conclusions and explanations) Social Studies: VS.1c (interpreting charts and graphs to glean information)

DTAN Teacher Competency 3. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

Data Representation | Tabular Representation | Grade 1 Maths For Kids | Periwinkle - Bing video ⬓ **(https://www.bing.com/videos/search? q=how+to+represent+data+in+tables&docid=608035500817529669&mid=E80F3ADE3EE1461E777FE80F3ADE3EE1 461E777F&view=detail&FORM=VIRE)**

DTAN Teacher Competency 4. Manipulate data sets in order to clean and process for analysis.

This teacher competency is aligned with the following Computer Science SOLs:

- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.
*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

DTAN 4 - Manipulating data.pdf (https://canvas.odu.edu/courses/185318/files/44846675/download?wrap=1) ↓ (https://canvas.odu.edu/courses/185318/files/44846675/download?download_frd=1) Ⓧ

MANIPULATING and Cleaning DATA
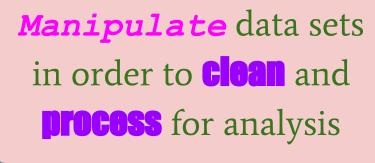
As we've seen **previously**...

DATA CAN BE COLLECTED BY A NUMBER OF

different TOOLS.

This might lead to **different size** data sets,

and even possible FORMATTING issues❗☹️

HOWEVER, data collected automatically by tools & sensors typically have

LOW chance of error.

Data collected by HAND, on the other hand, *(Pun intended?)*

has a HIGHER CHANCE of INCONSISTENCY or

~~ERRORS~~. Sometimes, it is the **ONLY** option❗

Here's an example...

Can You SPOT All the ISSUES?

"What did you do last night?"

Name	Date	Activity	Bedtime
Doe, Jane	10/25/2020	Watched Baseball	10:00pm
Jonathan Smith	October 25, 2020	Dodgers Game	
Benny	Oct. 25	Watched TV	I Didn't Sleep
Neil Armstrong	Landed	On	The Moon!

The Table Had All Types of Problems!

Date Formatting

Date
10/25/2020
October 25, 2020
Oct. 25

The date is in **3 different formats, and one has no year!**

Incomplete Fields

Name
Doe, Jane
Jonathan Smith
Benny
Neil Armstrong

Benny has **no last name.** Jane and Jonathan are in **different formats.**

Irrelevant Data Entries

Bedtime
10:00pm
I Didn't Sleep
The Moon!

"I Didn't Sleep" and "The Moon!" are **not useful** entries.

Missing Data

Bedtime
10:00pm
I Didn't Sleep
The Moon!

There is **no input** on this person's bedtime - it should say **"N/A".**

Data Consistency

Activity
Watched Baseball
Dodgers Game
Watched TV
On

Data must match in format. It could say **"Watched Baseball"** as well.

Fixing these issues is called **CLEANING** the data.

Cleaning data is **ESSENTIAL** for running **analysis** on it.

Now **THIS** Is A <u>Cleaner Data Set</u>!

"What did you do last night?"

Name	Date	Activity	Bedtime
Doe, Jane	10/25/2020	Baseball on TV	10:00pm
Smith, Jonathan	10/25/2020	Baseball on TV	10:30pm
Alvarez, Benny	10/25/2020	Movies	N/A
~~Neil Armstrong~~	~~Landed~~	~~On~~	~~The Moon!~~

Other Tools for MANIPULATING Data Tables

Filters

- Only see **certain values** or **types** of values.

- To **filter**, highlight the row with CATEGORIES

  and click the **Filter** button in the toolbar ( )

- Filtering rows on data is **very useful**

  for seeing a **desired subsection** of items

Other Tools for MANIPULATING Data Tables

Sorting

Recall: Module 4.3

- **Reorganize** rows by a **desired field**

  such as last name or date

- To **sort**, highlight the entire set

  and choose **Sort Range** in the **Data** dropdown

⚠️ Be sure the whole data set is selected, or IT MAY ONLY SORT A SINGLE COLUMN! ⚠️

DTAN Teacher Competency 4. Data Set Practice

Use the Sample Data Sets included below (also located on the Course Materials page) to try the following manipulations to re-order or view subsets of data.

*Note that the sample data sets have already been cleaned to have consistent values.

Instructions and tips for completing these practice activities can be found on slides 8 (filtering) and 9 (sorting/ordering) in the PDF for Teacher Competency 4 (this competency). You can also refer back to the slide deck for Teacher Competency 3 in this module (slides 13-15) for additional information on sorting and ordering.

Small Data Set 1

- Alphabetize the data set by student name
- Order the data set by bedtime

Small Data Set 2

- Alphabetize the data set by student name
- Order the data set by age
- Add a column to the right to categorize toys into groups

Medium Data Set

- Only show students with grades under 80
- Add column to the right to show total number of absences

Large Data Set

- Filter to only show the #1 song for each week
- Order songs by most weeks on board

Sample Data Sets

Below are a few sample data sets that you can use to try your own data analysis. There are 2 small data sets with less than 10 items, one medium data set with 50 items, and a large data set with 300,000 items. These data sets will not be included on the microcredential assessment, but rather are intended to help get you started in practicing your skills. Some individual teacher competency sections will include activities that use these data sets.

- Small data set 1: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846922?wrap=1)** ↓
  (https://canvas.odu.edu/courses/185318/files/44846922/download?download_frd=1)
  Google Sheets format ↪

(https://docs.google.com/spreadsheets/d/1fPhvuQarEpXYUaCzMC-J0kZa6uzlUpYdTOo_mJJ4RcA/copy)

- Small data set 2: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846943?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846943/download?download_frd=1)** Ⓧ **Google Sheets format** ⮕ **(https://docs.google.com/spreadsheets/d/13-kZilxkqSjRkd7d9yoQVURZK4LHDqWn3RX0UvgmDEk/copy)**

- Medium data set: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846939?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846939/download?download_frd=1)** Ⓧ **Google Sheets format** ⮕ **(https://docs.google.com/spreadsheets/d/16qJEc6epdslHbkFLOkN8ENTqdoTqyarzvbSwLsSkeHo/copy)**

- Large data set: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846921?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846921/download?download_frd=1)** Ⓧ

Name	Day	Weather	Outside	Outside	Dinner
Amir	Tuesday	Sunny	95	75	Chicken
Robin	Tuesday	Sunny	85	90	Ravioli
Karson	Thursday	Rainy	60	0	Pizza
Cameron	Saturday	Sunny	80	120	Hot Dog

Bath	Bedtime
Yes	8:00
No	9:00
Yes	8:30
Yes	8:30

Name	Age	Favorite Toy
Madison	5	Car
Priya	4	Puzzle
Jordan	5	Barbie
Terrell	6	Puzzle
Jason	7	Switch
Casey	7	Action Figure

Name	Attendance - Mon	Attendance - Tues	Attendance - Wed	Attendance - Thur	Attendance - Frida
Student1	Present	Absent	Present	Absent	Present
Student2	Present	Absent	Absent	Present	Present
Student3	Present	Present	Present	Present	Present
Student4	Present	Absent	Present	Present	Present
Student5	Present	Present	Present	Absent	Present
Student6	Absent	Present	Present	Present	Absent
Student7	Present	Absent	Absent	Present	Present
Student8	Present	Present	Present	Present	Present
Student9	Present	Present	Present	Present	Present
Student10	Absent	Present	Present	Present	Absent
Student11	Absent	Present	Present	Absent	Present
Student12	Present	Present	Absent	Present	Present
Student13	Absent	Present	Present	Present	Present
Student14	Present	Present	Present	Present	Absent
Student15	Present	Present	Present	Present	Present
Student16	Present	Absent	Present	Absent	Present
Student17	Absent	Present	Present	Present	Present
Student18	Present	Present	Present	Present	Absent
Student19	Present	Present	Present	Present	Present
Student20	Absent	Present	Present	Present	Present
Student21	Present	Present	Present	Present	Present
Student22	Present	Present	Absent	Present	Absent
Student23	Present	Present	Present	Present	Present
Student24	Absent	Present	Present	Absent	Present
Student25	Present	Present	Present	Present	Present
Student26	Present	Absent	Absent	Present	Present
Student27	Present	Present	Absent	Present	Present
Student28	Absent	Present	Present	Present	Present
Student29	Present	Present	Present	Absent	Present
Student30	Present	Absent	Present	Present	Present
Student31	Present	Absent	Present	Present	Present
Student32	Present	Present	Present	Present	Present
Student33	Present	Present	Present	Present	Present
Student34	Absent	Present	Present	Present	Present
Student35	Present	Present	Present	Present	Present
Student36	Present	Present	Absent	Present	Present
Student37	Present	Present	Present	Present	Present
Student38	Absent	Present	Present	Present	Present
Student39	Present	Present	Present	Present	Absent
Student40	Present	Present	Present	Present	Present
Student41	Present	Absent	Present	Present	Present
Student42	Present	Present	Present	Present	Present
Student43	Present	Present	Present	Present	Present
Student44	Absent	Present	Present	Present	Absent
Student45	Present	Present	Present	Present	Present

Student46	Present	Present	Present	Absent	Present
Student47	Absent	Present	Absent	Present	Present
Student48	Absent	Present	Present	Present	Present
Student49	Present	Absent	Present	Present	Present
Student50	Present	Present	Present	Present	Absent

Practice 1 Progress	Practice 2 Progress	Project Score
3	3	90
3	4	91
4	2	98
2	4	95
3	2	88
3	3	91
3	2	87
1	1	91
2	4	90
3	1	82
2	2	94
4	3	91
2	4	93
3	2	99
2	3	88
3	4	76
4	2	98
1	2	93
3	3	95
2	4	83
4	2	89
2	2	83
3	4	94
4	4	75
2	2	85
3	2	87
2	3	96
2	3	88
4	3	88
2	4	76
3	4	94
2	3	96
2	2	80
4	4	76
4	1	79
3	4	80
4	2	94
2	3	90
4	4	93
3	2	92
2	3	83
1	4	88
4	2	91
3	4	91
2	3	95

3	4	77
4	2	78
2	3	100
4	4	93
4	2	93

DTAN Teacher Competency 4. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competency 4. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 4.pdf (https://canvas.odu.edu/courses/185318/files/44846677/download?wrap=1) ↓ (https://canvas.odu.edu/courses/185318/files/44846677/download?download_frd=1)

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Light blue	Dark blue	Dark blue	Dark blue	Dark blue	Dark blue
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Light blue	Dark blue	Dark blue	Dark blue	Dark blue
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Light blue	Dark blue	Dark blue	Dark blue
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Light blue	Dark blue	Dark blue	Dark blue
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Light blue	Light blue	Dark blue
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Light blue	Light blue	Dark blue
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Light blue	Light blue

Light blue – Introduction   Dark blue - Proficient

DTAN Teacher Competency 4. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
3.12 The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.	Mathematics: 3.15 (collecting, organizing and interpreting data in pictograph and bar graph) Science: 3.1c (analyzing data in pictograph and bar graph); 3.1d (use evidence to support a construct or support an explanation) Social Studies: 3.1c (survey family members to determine ways they help their community, country, and world and create a web or a simple bar graph to show the results)
4.12 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	English: 4.5 (reading to draw conclusions); 4.7 (writing to make predictions) Mathematics: 4.14 (collecting, organizing, representing, and interpreting data in bar and line graphs) Science: 4.1a (develop hypothesis as cause and effect relations); 4.1c (interpreting, analyzing, and evaluating data)
5.11 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	Mathematics: 5.16 (represent data in a number of forms); 5.17 (describing data) Science: 5.1a (predict reasonable outcomes based on patterns); 5.1c (using tables and graphs to organize and analyze data); 5.1d (constructing and critiquing conclusions and explanations) Social Studies: VS.1c (interpreting charts and graphs to glean information)

DTAN Teacher Competency 4. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

Data Cleaning Steps and Techniques - Data Science Primer (elitedatascience.com) ⬀ **(https://elitedatascience.com/data-cleaning)**

Top ten ways to clean your data - Excel (microsoft.com) ⬀ **(https://support.microsoft.com/en-us/office/top-ten-ways-to-clean-your-data-2844b620-677c-47a7-ac3e-c2e157d1db19)**

DTAN Teacher Competency 5. Create visualizations based on the data represented.

This teacher competency is aligned with the following Computer Science SOLs:

- CS K.9. The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.
- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 3.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles).
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 4.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., solar system).
- CS 4.14. The student will use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB).
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.12. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., plate tectonics).
- CS 5.13. The student will use numeric values to represent non-numeric ideas in the computer (e.g., binary, ASCII, pixel attributes such as RGB).

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.

*We recommend that you right click on the link and choose "Open in New Tab" for best viewing.

DTAN 5 - Creating visualizations.pdf
(https://canvas.odu.edu/courses/185318/files/44846678/download?wrap=1) ↓
(https://canvas.odu.edu/courses/185318/files/44846678/download?download_frd=1)

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Light blue	Dark blue	Dark blue	Dark blue	Dark blue	Dark blue
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Light blue	Dark blue	Dark blue	Dark blue	Dark blue
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Light blue	Dark blue	Dark blue	Dark blue
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Light blue	Dark blue	Dark blue	Dark blue
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Light blue	Light blue	Dark blue
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Light blue	Light blue	Dark blue
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Light blue	Light blue

Light blue – Introduction   Dark blue - Proficient

DTAN Teacher Competency 5. Create visualizations based on the data represented.

This teacher competency is aligned with the following Computer Science SOLs:

- CS K.9. The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.
- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 3.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles).
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 4.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., solar system).
- CS 4.14. The student will use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB).
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.12. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., plate tectonics).
- CS 5.13. The student will use numeric values to represent non-numeric ideas in the computer (e.g., binary, ASCII, pixel attributes such as RGB).

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.
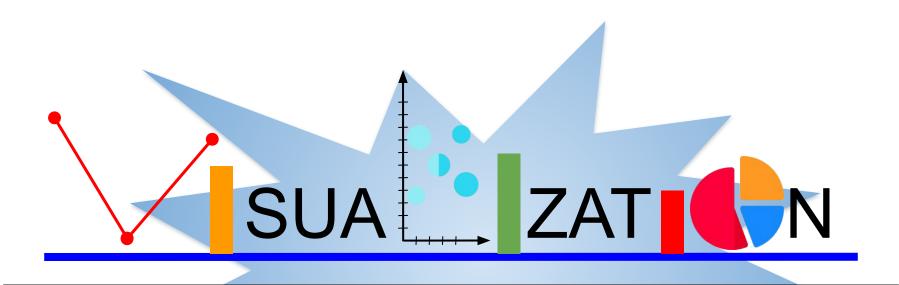
*We recommend that you right click on the link and choose "Open in New Tab" for best viewing.

DTAN 5 - Creating visualizations.pdf
(https://canvas.odu.edu/courses/185318/files/44846678/download?wrap=1) ⤓
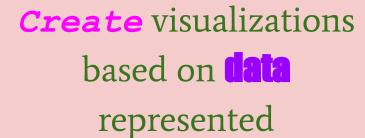**(https://canvas.odu.edu/courses/185318/files/44846678/download?download_frd=1)**

VISUALIZATION

and **DATA**

What is a Visualization?

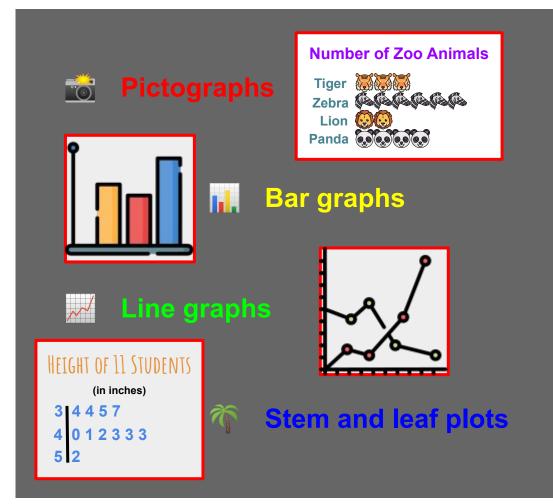Unlike `tables` `of` `data`, a **visualization** is a different **REPRESENTATION** of a dataset.

(As the name may imply.) It's **more visual** in NATURE, allowing more insight than tables.

Examples of visualizations include:

📷 **Pictographs**

Number of Zoo Animals

Tiger 🐯🐯🐯
Zebra 🦓🦓🦓🦓🦓
Lion 🦁🦁🦁
Panda 🐼🐼🐼🐼

📊 **Bar graphs**

📈 **Line graphs**

Height of 11 Students

(in inches)

3 | 4 4 5 7
4 | 0 1 2 3 3 3
5 | 2

🌴 **Stem and leaf plots**

Why Visualize?

Reading a data table can be easy...

... but identifying patterns, key features, and the underlying big picture is **not**!

This is especially true for **LARGER** data sets.

It would be **nearly impossible** to identify a pattern within potentially **THOUSANDS of rows** in a table.

However, visualizations can make it **very easy**!
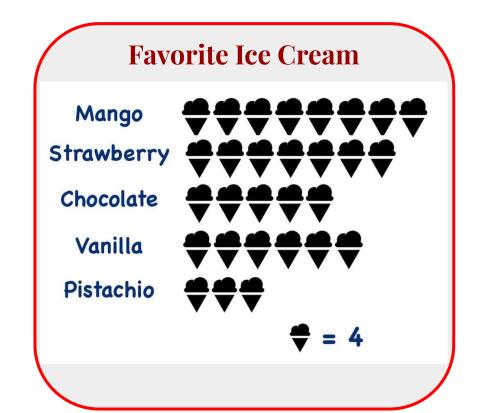
Pictograph

Why Choose a Pictograph?

Pictographs provide a
very visual count of objects.

As an **example**, this graph shows the
number of students
who identified their favorite
ice cream flavor.

Favorite Ice Cream

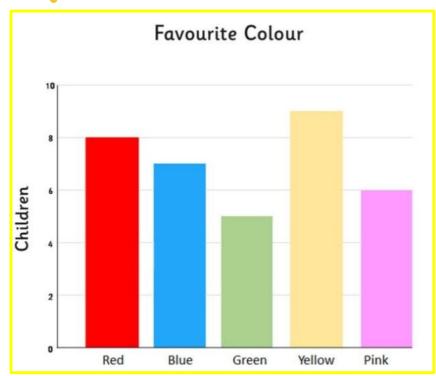Mango

Strawberry

Chocolate

Vanilla

Pistachio

🍦 = 4

Bar Graph

Why Choose a Bar Graph?

Bar graphs are similar to pictographs, but can be easier to compare the quantities.

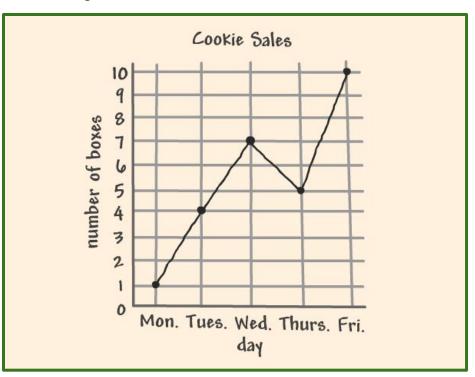As an example, this graph shows the number of students who identified certain colors as their favorite.

Favourite Colour

Line Graph

Why Choose a Line Graph?

Line graphs are great for showing **relationships** as a value **changes**.

As an **example**, this graph shows the **cookie sales** changing over **days of the week**.

Stem and Leaf Plot

Why Choose a Stem and Leaf Plot?

Stem and leaf plots are a **more advanced** visualization showing **groupings** of **numeric** values.

Numbers are **split** into their **first digit (the STEM)** and their **last digit (the LEAF)**.

Math Quiz Scores

```
3 | 4
4 | 3 4 7 7
5 | 2 2 4 4 7 7 8
6 | 0 2 2 3 4 4 4 4 7 9 9
7 | 2 3 3 4 5 5 6 6 6 6 6 7 7 8 8
8 | 0 1 1 4 6 7 7 7 9
9 | 1 2 2 4 5 8
```
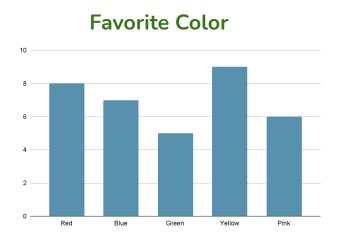
Good ✅ vs. Bad ❎ Visualizations

When picking a chart, **consider** what **relationship** you want to show.
*The **wrong type of chart** can make the pattern **more difficult** to see!*

Both graphs below show the **most frequent chosen color**, but
only the **bar graph** gives you the **actual** number counts.

Favorite Color (bar graph)

Red: 8, Blue: 7, Green: 5, Yellow: 9, Pink: 6

Favorite Color (pie chart)

Pink 17.1%, Red 22.9%, Blue 20.0%, Green 14.3%, Yellow 25.7%

So... Which One Should You Use?

Some data sets are easy to determine which **type** of graph is **most** appropriate.

(change over time is most likely a line graph!)

With others, it may not be as obvious,

but it never hurts to EXPERIMENT with different

chart types and `data fields` to see if a

pattern or **new observation** is present!

Examples of Everyday Digital

Visualizations

Phone Battery Percentage Indicator

Video Game Health Bar

Weather Map

Check out some other interesting examples below!
The 10 Best Data Visualization Examples | Tableau
The 25 Best Data Visualizations of 2020 [Examples] (visme.co)

These are only a **few** of many that we see and use every day!
*Can you think of any **other** visualizations that you use?*

Data: the STEPS

1. **Decide** *what data* to collect. What will you observe or convey?
2. **Select** the proper *tool(s)* for data collection. (ruler, surveys, etc.)
3. **Gather** subjects to *collect data from*. (people, plants, etc.)
4. **Observe** and *write the measurements* and responses.
5. **Place** results in a *table*.
6. **Clean** data for *consistency* and *accuracy*.
7. **Choose** the right *visualization* for the task.

DTAN Teacher Competency 5. Data Set Practice

Use the Sample Data Sets included below (also included on the Course Materials page) to create visualizations of the sample data sets to allow for new and interesting perspectives. There is a link to the data sets provided on the next page, or you can return to the main Course Materials folder using the menu bar on the left side of your screen.

Follow these instructions to create charts or graphs in Excel:

1. Open the data file

2. Select the "Insert" tab on the ribbon at the top of the window.

3. Select the data that you want to include in the chart or graph.

4. Select your desired chart or graph from the "Charts" section on the ribbon.

Small Data Set 1

- Pictograph of Sunny, Cloudy, and Rainy days

- Bar graph comparing bedtimes

Small Data Set 2

- Bar graph of student ages

- Pictograph of toys by category

Medium Data Set

- Bar graph showing total absences by day

- Line graph showing attendance by day

- Stem and leaf plot showing grade distribution

Large Data Set

- Bar graph of most appearances on list by artist

- Line graph showing path of Pharrell Williams - Happy on chart (Feel free to substitute for a different song)

Sample Data Sets

Below are a few sample data sets that you can use to try your own data analysis. There are 2 small data sets with less than 10 items, one medium data set with 50 items, and a large data set with 300,000 items. These data sets will not be included on the microcredential assessment, but rather are intended to help get you started in practicing your skills. Some individual teacher competency sections will include activities that use these data sets.

- Small data set 1: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846922?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846922/download?download_frd=1)** ⓧ **Google Sheets format** ↪ **(https://docs.google.com/spreadsheets/d/1fPhvuQarEpXYUaCzMC-J0kZa6uzlUpYdTOo_mJJ4RcA/copy)**

- Small data set 2: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846943?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846943/download?download_frd=1)** ⓧ **Google Sheets format** ↪ **(https://docs.google.com/spreadsheets/d/13-kZilxkqSjRkd7d9yoQVURZK4LHDqWn3RX0UvgmDEk/copy)**

- Medium data set: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846939?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846939/download?download_frd=1)** ⓧ **Google Sheets format** ↪ **(https://docs.google.com/spreadsheets/d/16qJEc6epdslHbkFLOkN8ENTqdoTqyarzvbSwLsSkeHo/copy)**

- Large data set: **Microsoft Excel format (https://canvas.odu.edu/courses/185318/files/44846921?wrap=1)** ↓ **(https://canvas.odu.edu/courses/185318/files/44846921/download?download_frd=1)** ⓧ

DTAN Teacher Competency 5. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competency 5. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 5.pdf (https://canvas.odu.edu/courses/185318/files/44846676/download?wrap=1) ↓ (https://canvas.odu.edu/courses/185318/files/44846676/download?download_frd=1)

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Introduction	Proficient	Proficient	Proficient	Proficient	Proficient
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Introduction	Proficient	Proficient	Proficient	Proficient
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Introduction	Proficient	Proficient	Proficient
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Introduction	Proficient	Proficient	Proficient
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Introduction	Introduction	Proficient
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Introduction	Introduction	Proficient
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Introduction	Introduction

Light blue – Introduction   Dark blue - Proficient

DTAN Teacher Competency 5. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
K.9 The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.	Mathematics: K.11 (data collection and interpretation) Science: K.1 (across all science standards)
1.11 The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 1.12a (collect and organize data using various forms of data collection and represent data in tables, picture graphs, and object graphs) Science: 1.1c (organize and represent various forms of data using tables, picture graphs, and object graphs)
2.11 The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 2.15a (collecting, organizing, and representing data in pictographs and bar charts) Science: 2.1c (organize and represent data in pictographs and bar graphs)
3.12 The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.	Mathematics: 3.15 (collecting, organizing and interpreting data in pictograph and bar graph) Science: 3.1c (analyzing data in pictograph and bar graph); 3.1d (use evidence to support a construct or support an explanation) Social Studies: 3.1c (survey family members to determine ways they help their community, country, and world and create a web or a simple bar graph to show the results)
3.13 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles).	Mathematics: 3.1a (using models to illustrate relationships between 100s, 10s, and 1s); 3.4a (representation of multiplication and division through models) Science: 3.1e (use models to demonstrate simple phenomena and natural processes); 3.5b (food chain models); 3.7c (water cycle modeling)

Computer Science Standard	Opportunity for Integration
4.12 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	English: 4.5 (reading to draw conclusions); 4.7 (writing to make predictions) Mathematics: 4.14 (collecting, organizing, representing, and interpreting data in bar and line graphs) Science: 4.1a (develop hypothesis as cause and effect relations); 4.1c (interpreting, analyzing, and evaluating data)
4.13 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., solar system).	Mathematics: 4.2 (modeling fractions and real numbers); 4.4d (use models to represent understanding of multiplication); 4.13c (modeling probability) Science: 4.1e (use of models); 4.3b (modeling ecosystems); 4.5 (model revolution vs rotation, model location and relative sizes of planets); 4.6 (model sun/moon/earth relationship); 4.7c (model of marine food chain)
5.11 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	Mathematics: 5.16 (represent data in a number of forms); 5.17 (describing data) Science: 5.1a (predict reasonable outcomes based on patterns); 5.1c (using tables and graphs to organize and analyze data); 5.1d (constructing and critiquing conclusions and explanations) Social Studies: VS.1c (interpreting charts and graphs to glean information)
5.12 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., rocks).	Mathematics: 5.6b (solving problems using models) Science: 5.1e (developing and using models); 5.2 (modeling energy transformations); 5.4 (modeling electrical flow); 5.7 (modeling atoms in matter); 5.8 (modeling plate movement) Social Studies: VS.1c (using maps and models to analyze historical change); VS.1j (modeling geographic and demographic differences in Virginia's 5 regions)
5.13 The student will use numeric values to represent non-numeric ideas in the computer (e.g., binary, ASCII, pixel attributes such as RGB).	Mathematics: 5.19a (describing a variable as a representation of an unknown quantity)

DTAN Teacher Competency 5. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

Weather Radar GIF: **Weather radar GIFs - Get the best GIF on GIPHY** ⤷ **(https://giphy.com/explore/weather-radar)**

Other Visualization Examples:

The 10 Best Data Visualization Examples | Tableau ⤷ **(https://www.tableau.com/learn/articles/best-beautiful-data-visualization-examples)**

The 25 Best Data Visualizations of 2020 [Examples] (visme.co) ⤷ **(https://visme.co/blog/best-data-visualizations/)**

Published   Preview   Assign To   Edit   ⋮

DTAN Module 2 Quiz

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment
for this course.
You can take the quiz up to three times.

Quiz Type	Graded Quiz
Points	120
Assignment Group	Imported Assignments
Shuffle Answers	No
Time Limit	No Time Limit
Multiple Attempts	Yes
Score to Keep	
Attempts	3
View Responses	Always
Show Correct Answers	Immediately
One Question at a Time	No
Require Respondus LockDown Browser	No
Required to View Quiz Results	No

Due	For	Available from	Until
-	Everyone	-	-

Preview

DTAN Module 2 Quiz

⚠ This is a preview of the published version of the quiz

Started: Sep 20 at 10:22am

Quiz Instructions

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment for this course.
You can take the quiz up to three times.

⠿

Question 1 10 pts

Which factor is the following table sorted by?

Student Name	Date Completed	Assignment Type	Passing
Cameron	7/29/2021	Quiz	No
Kristy	7/20/2021	Worksheet	Yes
Mandy	7/23/2021	Test	Yes
Nick	8/1/2021	Test	Yes
Tashawn	7/25/2021	Worksheet	No

○
Name

○
Date Completed

○
Assignment Type

○
Passing

⠿

Question 2 10 pts

Which of the following is a drawback of sorting a set of data into a table?

○
Possible data loss in transfer

○
Difficult to see patterns in a large data set

○
Harder to find a particular entry

○
Tells a narrative story about the given scenario

⠿

Question 3 10 pts

In order for analysis to be done on a data set, visualizations must be made from the data tables.

○
True

○
False

⠿

Question 4 10 pts

Sorting data points in a table allows for an analyst to...

☐
Hide extraneous values that can throw off analysis

☐
Only show the values that fit a desired result

☐
Narrow the visible elements of data

☐
Find the largest or smallest value

⠿

Question 5 10 pts

Which of the following would NOT be a description of a set of "raw data"?

○
The date range of responses to a classwide survey

○
Temperate values recorded by a thermometer

○
The speeds recorded of cars in a speed trap

○
Favorite drinks by a class of students

⠿
Question 6 10 pts

What technique could lead to a data set needing to be cleaned before analyzing?

○
Using automatically generated data from a sensor

○
Obtaining a data set from a trusted source like Kaggle

○
Using open ended questions in a survey

○
Generating data from mathematical calculations

⠿
Question 7 10 pts

Formatting of values such as degrees Celsius or Fahrenheit can cause problems when sorting a table.

○
True

○
False

⠿
Question 8 10 pts

The following table representing responses from a survey would need to be cleaned before it can be analyzed.

Name	Date Completed
Reagan	3/21/2021
Billy	3/20/2021
Robert	3/23/2021

Erin	3/20/2021
Dominique	3/20/2021

○
True

○
False

⋮⋮
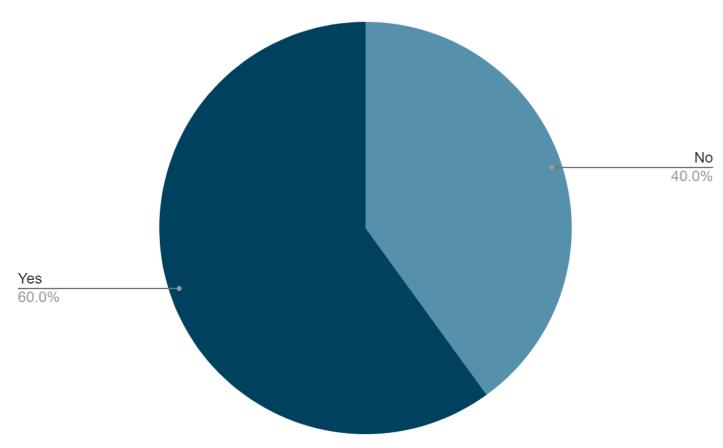
Question 9 10 pts

Which visualization is NOT accurate for the included data table?
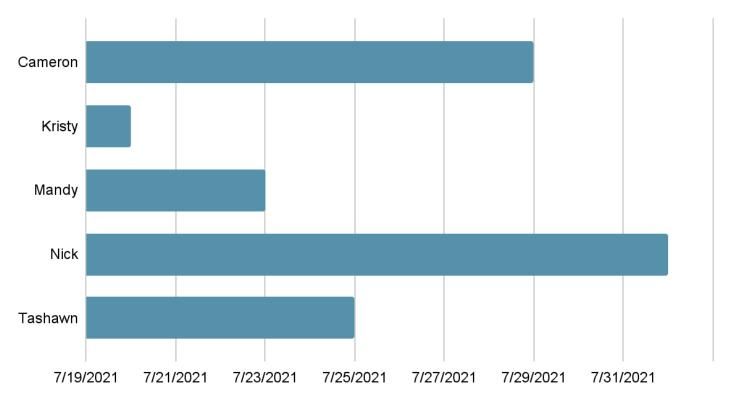
Student Name	Date Completed	Assignment Type	Passing
Cameron	7/29/2021	Quiz	No
Kristy	7/20/2021	Worksheet	Yes
Mandy	7/23/2021	Test	Yes
Nick	8/1/2021	Test	Yes
Tashawn	7/25/2021	Worksheet	No

○

No
40.0%

Yes
60.0%

○

Points scored

| | 7/19/2021 | 7/21/2021 | 7/23/2021 | 7/25/2021 | 7/27/2021 | 7/29/2021 | 7/31/2021 |

○

○
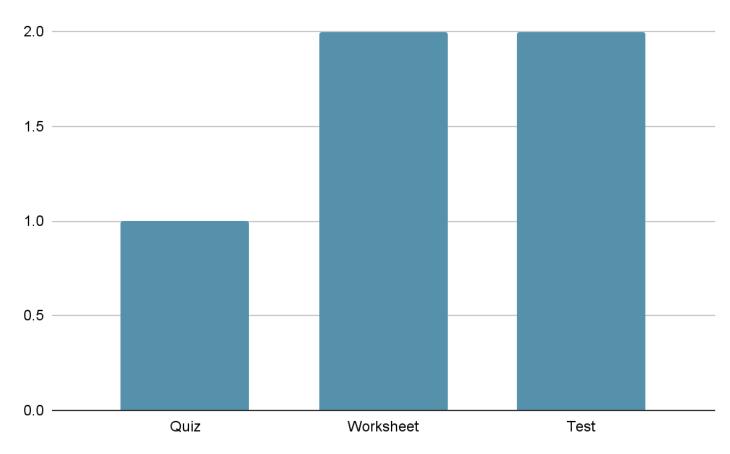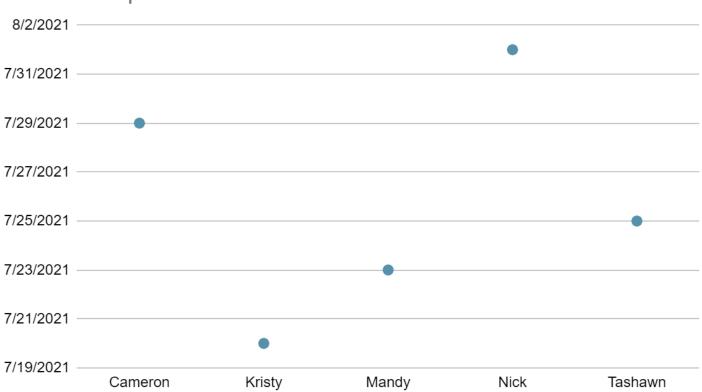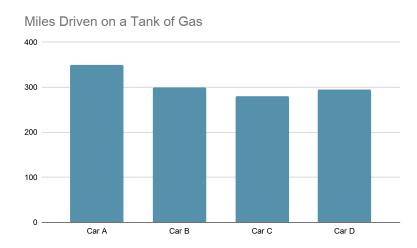
Dates Completed

⋮⋮

Question 10 10 pts

Based on the following chart, which car gets the worst gas mileage per gallon?

Miles Driven on a Tank of Gas

○

Car A

○

Car B

○

Car C

○

Car D

⋮⋮

Question 11 10 pts

A line graph is typically used to represent what type of data?

○

Change over time

○

Percent of a whole

○

Most commonly occurring value

○

Average value in a collection

⋮⋮

Question 12 10 pts

The same conclusion will be reached about a data set regardless of what type of chart is used.

○
True

○
False

Not saved   Submit Quiz

Data and Analysis Module 3

When you complete this learning module, you should be able to:

- **Use** the data, tables, and visualizations to **identify** patterns and **answer** questions.
- **Use** the data, tables, and visualizations to **make predictions**.

Teacher Competencies 6 & 7 and Alignment with CS SOLs

This learning module includes two teacher competencies (in bold), both of which are aligned with the following Computer Science SOLs (bulleted):

- DTAN Teacher competency 6 is about answering questions using visualizations, while 7 is about making predictions. Because these two competencies are related, we have consolidated the content for these two modules into one presentation.

DTAN Teacher Competency 6. Use data, tables, and visualizations to identify patterns and answer questions

DTAN Teacher Competency 7. Use data, tables, and visualizations to make predictions.

- CS K.9. The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.
- CS 1.11. The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 2.11. The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.
- CS 3.12. The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.
- CS 3.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles).
- CS 4.12. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 4.13. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., solar system).
- CS 5.11. The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.
- CS 5.12. The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., plate tectonics).

In this course, we present content in PDF format. The attached file contains information that addresses this particular teacher competency.

*We recommend that you right click on the link and choose "Open in New Tab" for best viewing.

DTAN 6 and 7 - Identifying patterns and making predictions.pdf
(https://canvas.odu.edu/courses/185318/files/44846679/download?wrap=1) ⤓

(https://canvas.odu.edu/courses/185318/files/44846679/download?download_frd=1) ♿
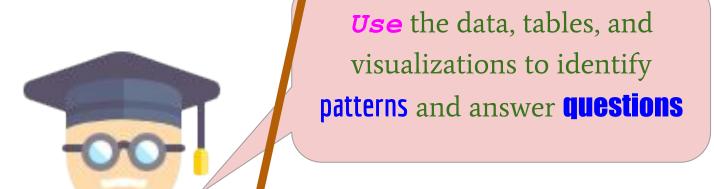
Using VISUALIZATIONS to Answer Questions
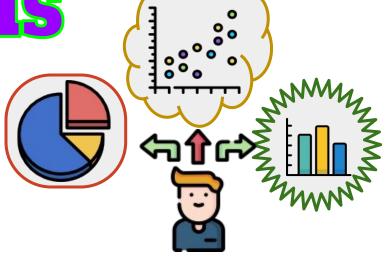
LOOKING FOR Patterns

As mentioned before,

finding a pattern in data

can be tricky!

Trying different *chart formats*

and *field variables* can yield

some surprising results.

⚠️ **Note:** ⚠️

These patterns will be **very important** for

DRAWING CONCLUSIONS and answering **questions.**

Sometimes, *there is no pattern.*

That's not always a bad thing…

… it can tell you **just as much** about a data set!

Answering ?uestions

Based on the **Data**

Various formats **(table vs visualization)**

allow for different questions

to be answered

more easily **!**

Answers from the Data

What was the data **about**?

How many data points were collected?

What **dates** were these data collected?
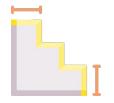
What was the **average** value?

Answers from the *Visualization*

What's the **largest** value?

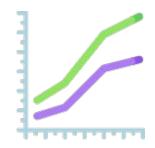What's the **smallest** value?

Did the value go **up** or **down** over time?

Was a type of value more **frequently** occurring?

WARNING!

Just because two values occur in the **same graph** or **seem related**, it does not always mean that they are!

Correlation does NOT equal causation

Making Predictions

What is a **Prediction?**

Predictions can be made based on

patterns and **trends**

identified in existing data sets.

These can suggest that a future trial

may end a **certain way**,

or that <u>no pattern</u> can be seen.

Types of Patterns

Increasing - Data values are going **up** over time

Decreasing - Data values are going **down** over time

Repeating - Data values follow a predictable pattern that **repeats**

No Pattern - No future values can be predicted

Things to **Keep** in **Mind**

Time is NOT always necessarily a factor

- Some patterns in data **aren't affected** by passage of time
- **Be cautious** when making predictions time-oriented

Do you have ENOUGH data to identify a pattern?

- Many patterns won't appear until a **large number of values** are collected...
- ... Or **vice versa** - a small data set may make it look like a pattern is present!

DTAN Teacher Competencies 6 & 7. Data Set Practice 1

Use the visualizations you created in the previous module to identify patterns and answer questions for the following:

Small Set 1
- What type of weather occurred the most this week?
- When do most kids go to bed?
- Why was Karson spending so little time outside?

Small Set 2
- What's the average age of the students?
- What type of toys do kids like?

Medium Set
- What day had the most students in attendance?
- Did higher attendance correlate to higher grade?

Large Set
- What was the average duration of a Beatles song on the chart?
- What song lasted the longest at #1?
- What song last the longest anywhere on the chart?

DTAN Teacher Competencies 6 & 7. Data Set Practice 2

Now, use your data sets, tables, and visualizations to make predictions about the data and scenarios they describe.

Small Set 1
- What will the weather be like on Sunday?
- Is it likely that a random student will spend time outside on a sunny day?

Small Set 2
- What types of toys should be marketed this coming holiday season?

Medium Set
- Should attendance be required for this activity in the future?

Large Set
- What will most likely be the #1 song next week?

DTAN Teacher Competencies 6 & 7. Curricular Alignment and Curriculum Framework

The information contained in this section will help you as you begin to develop your lesson plan for this course, including the following information for this competency:

- Computer Science SOL vertical alignment (K-5)
- Cross-curricular alignment
- Background information and Essential Skills, Questions, and Vocabulary (Curriculum Framework)

DTAN Teacher Competencies 6 & 7. CS SOL Vertical Alignment (K-5)

The attached file illustrates the vertical alignment of this CS SOL competency across K-5 grade span. The yellow highlighted areas indicate the CS standards with which this teacher competency align. The light blue shaded areas indicate introductory level skills and the dark blue shaded areas indicate proficiency of the standards.

Please note that this vertical alignment document was developed by TCEP faculty and has not been vetted by the VDOE or CodeVA.

DTAN Vertical Alignment 6 and 7.pdf
(https://canvas.odu.edu/courses/185318/files/44846681/download?wrap=1) ⤓
(https://canvas.odu.edu/courses/185318/files/44846681/download?download_frd=1) ⓧ

Computer Science SOLs	Grade					
Data and Analysis	K	1	2	3	4	5
Gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device. K.9	Light blue	Dark blue	Dark blue	Dark blue	Dark blue	Dark blue
Identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device. 1.11		Light blue	Dark blue	Dark blue	Dark blue	Dark blue
Compare and contrast examples of how computing technology has changed and improved the way people live, work, and interact. 2.11			Light blue	Dark blue	Dark blue	Dark blue
Create a model of a physical object or process in order to show relationships with or without a computing device (e.g., water cycle, butterfly life cycle, seasonal weather patterns). 2.12			Light blue	Dark blue	Dark blue	Dark blue
Use a computer to observe and analyze data in order to draw conclusions and make predictions. 3.12, 4.12, 5.11 (observe, analyze and manipulate data)				Light blue	Light blue	Dark blue
Create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles). 3.13, 4.13, 5.12				Light blue	Light blue	Dark blue
Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB). 4.14, 5.13					Light blue	Light blue
Light blue – Introduction Dark blue - Proficient						

DTAN Teacher Competencies 6 & 7. CS Cross-Curricular Alignment (K-5)

Listed below are some suggested areas of integration from the VDOE, but this is not an exhaustive list. What areas do you see for cross-curricular alignment?

Computer Science Standard	Opportunity for Integration
K.9 The student will gather and display data and organize it in a chart or graph in order to answer questions about the data, with or without a computing device.	Mathematics: K.11 (data collection and interpretation) Science: K.1 (across all science standards)
1.11 The student will identify and interpret data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 1.12a (collect and organize data using various forms of data collection and represent data in tables, picture graphs, and object graphs) Science: 1.1c (organize and represent various forms of data using tables, picture graphs, and object graphs)
2.11 The student will construct and analyze data and organize it in a chart or graph in order to make a prediction, with or without a computing device.	Mathematics: 2.15a (collecting, organizing, and representing data in pictographs and bar charts) Science: 2.1c (organize and represent data in pictographs and bar graphs)
3.12 The student will answer questions by using a computer to observe data in order for the student to draw conclusions and make predictions.	Mathematics: 3.15 (collecting, organizing and interpreting data in pictograph and bar graph) Science: 3.1c (analyzing data in pictograph and bar graph); 3.1d (use evidence to support a construct or support an explanation) Social Studies: 3.1c (survey family members to determine ways they help their community, country, and world and create a web or a simple bar graph to show the results)
3.13 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., day and night, animal life cycles, plant life cycles).	Mathematics: 3.1a (using models to illustrate relationships between 100s, 10s, and 1s); 3.4a (representation of multiplication and division through models) Science: 3.1e (use models to demonstrate simple phenomena and natural processes); 3.5b (food chain models); 3.7c (water cycle modeling)

Computer Science Standard	Opportunity for Integration
4.12 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	English: 4.5 (reading to draw conclusions); 4.7 (writing to make predictions) Mathematics: 4.14 (collecting, organizing, representing, and interpreting data in bar and line graphs) Science: 4.1a (develop hypothesis as cause and effect relations); 4.1c (interpreting, analyzing, and evaluating data)
4.13 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., solar system).	Mathematics: 4.2 (modeling fractions and real numbers); 4.4d (use models to represent understanding of multiplication); 4.13c (modeling probability) Science: 4.1e (use of models); 4.3b (modeling ecosystems); 4.5 (model revolution vs rotation, model location and relative sizes of planets); 4.6 (model sun/moon/earth relationship); 4.7c (model of marine food chain)
5.11 The student will use a computer to observe, analyze, and manipulate data in order to draw conclusions and make predictions.	Mathematics: 5.16 (represent data in a number of forms); 5.17 (describing data) Science: 5.1a (predict reasonable outcomes based on patterns); 5.1c (using tables and graphs to organize and analyze data); 5.1d (constructing and critiquing conclusions and explanations) Social Studies: VS.1c (interpreting charts and graphs to glean information)
5.12 The student will create an artifact using computing systems to model the attributes and behaviors associated with a concept (e.g., rocks).	Mathematics: 5.6b (solving problems using models) Science: 5.1e (developing and using models); 5.2 (modeling energy transformations); 5.4 (modeling electrical flow); 5.7 (modeling atoms in matter); 5.8 (modeling plate movement) Social Studies: VS.1c (using maps and models to analyze historical change); VS.1j (modeling geographic and demographic differences in Virginia's 5 regions)

DTAN Teacher Competencies 6 & 7. Additional Resources

Here are some additional resources that may be of interest to you. Please note that ODU is not responsible for the content contained on external sites.

*We recommend that you right click on the links and choose "Open in New Tab" for best viewing.

What Is Data Analysis? Methods, Techniques, Types & How-To (datapine.com) ⮥ **(https://www.datapine.com/blog/data-analysis-methods-and-techniques/)**

Analyzing Data - TeacherVision ⮥ **(https://www.teachervision.com/graph-chart-0/analyzing-data)**

Identify Possible Outcomes - Make Predictions - Bing video ⮥ **(https://www.bing.com/videos/search? q=how+to+make+predictions+with+data+kids&docid=60804777153572078&mid=CC9B44EFA15D651D42F1CC9B4 4EFA15D651D42F1&view=detail&FORM=VIRE)**

Published   **Preview**   Assign To   ✎ **Edit**   ⋮

DTAN Module 3 Quiz

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment for this course.

You can take the quiz up to three times.

Quiz Type	Graded Quiz
Points	60
Assignment Group	Imported Assignments
Shuffle Answers	No
Time Limit	No Time Limit
Multiple Attempts	Yes
Score to Keep	
Attempts	3
View Responses	Always
Show Correct Answers	Immediately
One Question at a Time	No
Require Respondus LockDown Browser	No
Required to View Quiz Results	No

Due	For	Available from	Until
-	Everyone	-	-

Preview

DTAN Module 3 Quiz

⚠ This is a preview of the published version of the quiz
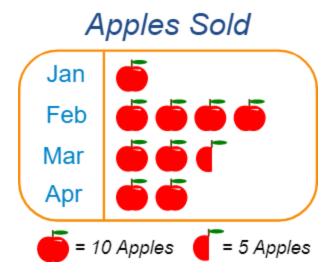
Started: Sep 20 at 10:35am

Quiz Instructions

This mini-quiz is optional but recommended as completion will help prepare you for the final assessment for this course.

You can take the quiz up to three times.

⠿

Question 1   10 pts

Check all of the following questions that could be answered regarding the pictograph.

☐
What led to low sales in January?
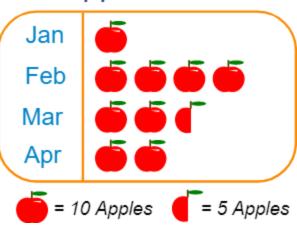
☐
Which student had the most apple sales?

☐
What month saw the highest sales?

☐
Were there sufficient sales to reach the group's goal?

⠿

Question 2   10 pts

Which of the following would be a conclusion that can be made from the pictograph?

Apples Sold

Jan	🍎
Feb	🍎🍎🍎🍎
Mar	🍎🍎🍎
Apr	🍎🍎

🍎 = 10 Apples   🍎 = 5 Apples

○

The least apples were sold in April

○

10 students were responsible for most of the apple sales

○

The high price of apples prevented more sales

○

95 total apples were sold

⠿

Question 3 10 pts

According to the table, is there more likely to be rain in the morning or afternoon?

Date	Time	Rained
7/24/2021	8:00	No
7/24/2021	16:00	Yes
7/25/2021	8:00	Yes
7/25/2021	16:00	Yes
7/26/2021	8:00	No

7/26/2021	16:00	Yes
7/27/2021	8:00	No
7/27/2021	16:00	No
7/28/2021	8:00	No
7/30/2021	16:00	Yes

○
Morning

○
Afternoon

○
Inconclusive

⁞

Question 4 10 pts

If a line graph displaying the price of gasoline shows that values have gone down over the last year, you can assume that prices will continue to decrease.
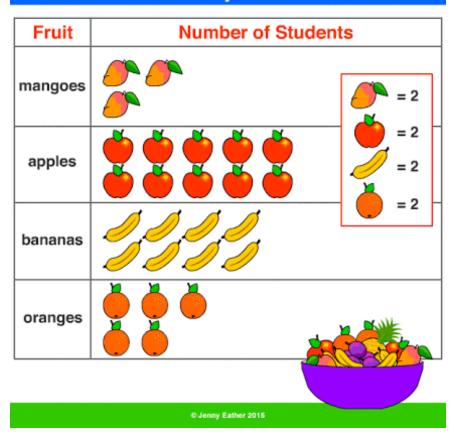
○
True

○
False

⁞

Question 5 10 pts

Based on the following pictograph, what fruit do students enjoy eating the least?

concrete graph, pictogram, pictograph

Pictures may represent one or more items.

Student Survey - Fruits Eaten
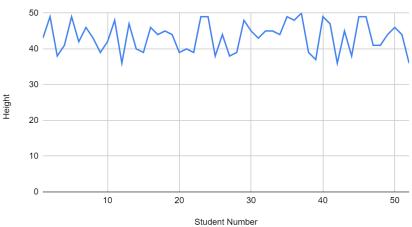
○
Mangoes

○
Apples

○
Bananas

○
Oranges

⋮⋮

Question 6 10 pts

Based on the provided visualization, John concludes that most students are between 35 and 50in tall. If more students are added to the class, he can assume that those students' heights will probably go...

Height vs. Student Number

○
Up

○
Down

○
Stay the same

○
Not enough information

Not saved   Submit Quiz

Lesson Planning Instructions and Resources

In addition to completing the Final Assessment for this microcredential, you also need to submit a lesson plan that incorporates the CS SOL standards covered in this course along with a self-reflection statement.

This page contains information designed to assist you in this assignment.

Instructions for the assignment:

1. Select a grade level appropriate Computer Science standard or standards associated with any of the modules contained in this microcredential and design a lesson for your students using the 5E lesson format. The lesson can include computer science standards integrated with a core content area standard or computer science standards only.
2. Use the information contained in the Curricular Alignment and Curriculum Framework sections of the modules as well as the Lesson Plan Organizer, Blooms Taxonomy chart and Lesson Plan Checklist, all included in this module, to assist you in your lesson design.
3. Design your final lesson on the Lesson Plan Template (also included in this module) and save your lesson plan as Your Name_Lesson Title.
4. Need additional help? See the two sample lesson plans in this module to get you started.
5. Complete your Self-Reflection (see instructions on the next page in this module) and save as YourName_Reflection.
6. Upload your lesson plan and self reflection using the "Lesson Plan Submission" link below.

[Click here to submit your Lesson Plan Assignment (https://canvas.odu.edu/courses/185318/assignments/2703187)](https://canvas.odu.edu/courses/185318/assignments/2703187) or navigate through this module and submit where instructed.

Lesson Plan Brainstorm

Fill in the icons with a lesson component ideas

Engage: How will I capture student's interest?

Explore: Describe hands-on / minds-on activities students will be doing. List "Big Idea" questions.

Explain: What techniques can I use to help students connect the exploration to the concept?

Elaborate: What vocabulary will be introduced? How will the knowledge be applied to daily life?

Evaluate: How will students demonstrate that they have achieved the lesson objective?

ARCS Microcredential Lesson Plan Self-Reflection Instructions

Please submit a statement of self-reflection for the lesson plan assignment for this course. Your self-reflection should be in narrative format and be no longer than 250 words.

There is no template for this part of the assignment, but please ensure that all of the following are present:

- Reflection offers insight into why the topic(s) and SOL(s) were chosen as the focus of the lesson.
- Reflection describes how the teacher drew on their content knowledge to design the lesson.
- Reflection describes how teacher drew on their pedagogical knowledge to design the lesson.
- Reflection describes how the lesson could be modified to support one or more groups of diverse learners.

ARCS Microcredential Lesson Rubric

Part A. Lesson Plan Format and Instructional Goals

Teacher competency:	Pass
The lesson plan follows the 5E lesson format.	All of the following are present: ☐ The lesson is organized in the 5E format. ☐ All of the E sections are present: Engage, Explore, Explain, Elaborate, and Evaluate. ☐ The topic of the lesson is evident in all of the E sections.
The lesson plan includes instructional goals and objectives, sometimes referred to as Learning Targets.	All of the following are present: ☐ Instructional goals/objectives are clearly labeled. ☐ What the learner will know and be able to do are clearly stated. ☐ The Evaluate section addresses students' acquisition of the instructional goals and objectives.

Part B. SOL Content Selection and Integration

Teacher competency:	Pass
The lesson is designed around a Virginia Computer Science SOL. A content area SOL is optional except in the Lesson Integration Microcredential.	All of the following are present: ☐ The grade level CS SOL is clearly identified. ☐ Key vocabulary terms are presented. ☐ The Engage or Explore portions of the lesson allow students to enact the CS Standard, Skills and Concepts.
**Lesson Integration Microcredential Lesson Plan: The lesson includes a content area SOL as well as a CS SOL.	All of the following are present: ☐ The grade level content area SOL (e.g. math, science) is clearly identified. ☐ Key vocabulary terms for the content area SOL are presented. ☐ Two or more portions of the lesson plan allow students to enact CS and content area Standards, Skills, and Concepts.

Part C. Instructional Delivery

Teacher competency:	Pass
The lesson describes grade level appropriate instructional strategies.	All of the following are present: ☐ For each of the 5E sections, an appropriate instructional strategy is described. ☐ For each of the 5E sections, the lesson plan includes information about anticipated teacher and student behavior. ☐ The instructional strategies allow for the student to demonstrate the actions listed in the SOL (e.g. create, construct).
The lesson includes appropriate materials and technology.	All of the following are present: ☐ Materials (and technology, if needed) are developmentally appropriate. ☐ All necessary materials (and technology, if needed) are clearly listed. ☐ The selected materials (and technology, if needed) enhance learning.

Part D. Teacher reflection

Teacher competency:	Pass
A statement is included in which the teacher reflects on their own areas of professional growth.	All of the following are present: ☐ Reflection offers insight into why the topic(s) and SOL(s) were chosen as the focus of the lesson. ☐ Reflection describes how the teacher drew on their content knowledge to design the lesson. ☐ Reflection describes how teacher drew on their pedagogical knowledge to design the lesson. ☐ Reflection describes how the lesson could be modified to support one or more groups of diverse learners.

ARCS Lesson Plan Template

Lesson Title:	Duration:
CS Standard:	**Content area standard (if applicable):**

Essential Question(s):

Student Objectives: I can ...

Vocabulary:

Differentiation strategies:

Resources:

Engage:	
Explore:	
Explain:	
Elaborate:	
Evaluate:	

Attachments (as needed)

Student materials

Published   **Preview**   Assign To   **Edit**   ⋮

DTAN Final Assessment

This assessment is designed to test your content knowledge for the Data and Analysis microcredential course. You must earn at least 80 percent to receive a passing score.
You may take the test up to three times.

Quiz Type	Graded Quiz
Points	100
Assignment Group	Imported Assignments
Shuffle Answers	No
Time Limit	No Time Limit
Multiple Attempts	Yes
Score to Keep	Highest
Attempts	3
View Responses	Always
Show Correct Answers	Immediately
One Question at a Time	No
Require Respondus LockDown Browser	No
Required to View Quiz Results	No

Due	For	Available from	Until
-	Everyone	-	-

Preview

DTAN Final Assessment

⚠ **This is a preview of the published version of the quiz**

Started: Sep 20 at 10:45am

Quiz Instructions

This assessment is designed to test your content knowledge for the Data and Analysis microcredential course. You must earn at least 80 percent to receive a passing score.
You may take the test up to three times.

⠿

Question 1 4 pts

What types of information can be "data"?

○ Numbers like height or speed

○ Text like name or month

○ Pictures or GPS locations

○ All of the above

⠿

Question 2 4 pts

Quantitative data consists of numbers and concepts that can be counted.

○ True

○ False

⠿

Question 3 4 pts

What is an advantage of using a tool such as a sensor to collect data over entering data by hand? Check all that apply.

☐ Less likely to have user input error

☐ Easier to generate a large amount of data

☐ Can double check for validity as data is entered

☐
Familiarity with data as it is input increases the understanding of any trends or patterns

⠿

Question 4 4 pts

Which of the following is not typically considered when grouping data points?

○
Color

○
Author

○
File type

○
Date

⠿

Question 5 4 pts

Can data be sorted by multiple factors?

○
No, data can only be sorted on one factor

○
Yes, one factor will be considered first followed by the other factor(s)

○
Yes, but two factors will create separate sorted tables

⠿

Question 6 4 pts

Which of the following are NOT methods for data collection?

○
Bar graphs

○
Web surveys

○
Timers

○
Interviews

⠿

Question 7 4 pts

It is easier to generate large data sets for analysis using tools such as sensors.

○
True

○
False

⋮⋮

Question 8 4 pts

Which of the following is a benefit of sorting a set of data in a table?

○
Can view all the data on one screen

○
Easier to find a particular data entry

○
Easier to find patterns within the data set

○
Tells a narrative story about the given scenario

⋮⋮

Question 9 4 pts

By which factor is the table below sorted?

Student Name	Date Planted	Plant Type	Bloomed
Reagan	3-9-2021	Daisy	No
Jessica	3-9-2021	Fern	Yes
Carter	3-10-2021	Fern	Yes
Peter	3-11-2021	Tulip	Yes
Maria	3-11-2021	Daisy	No

○
Name

○
Date Planted

○
Plant Type

○
Bloomed

⋮⋮

Question 10 4 pts

Some analysis can be done on a data set in a table without needing to create a visualization.

○
True

○
False

⠿

Question 11 4 pts

Filtering data points out of a table allows for an analyst to _____. Check all that apply.

☐
Hide extraneous values that can throw off analysis

☐
Only show the values that show a desired result

☐
Narrow the visible elements of the data

☐
Increase the data points for a given scenario

⠿

Question 12 4 pts

Formatting of values such as MM/DD/YYYY or DD/MM/YYYY can cause problems when sorting a table.

○
True

○
False

⠿

Question 13 4 pts

Which of the following would NOT be a description of a set of "raw data?"

○
A class's response to a multiple choice question

○
A survey response indicating a preferred session date from a list

○
The date and timestamp from a survey completion

○
A summary of the responses from an essay question

⠿

Question 14 4 pts

The following table representing responses from a survey would need to be "cleaned" before it can be analyzed.

Name	Date Completed
Josh	3/11/2021
Kelly	3/10/2021
Kyle	8/3/2021
Haley	3-10-2021
Talia	3/10/21

○ True

○ False

⋮⋮

Question 15 4 pts

What is a strategy to avoid needing to clean data from a survey?

○
Avoid open ended questions where possible

○
Provide a sample response to a survey question

○
Ensure you know all the people taking the survey

○
Don't use automatically generated field data

⋮⋮

Question 16 4 pts

A pie chart is typically used to represent what type of data?

○
Change over time

○
Percent of a whole

○
Speed of a projectile

○
Average value in a collection

⋮⋮

Question 17 4 pts

Different types of charts can lead to different conclusions being drawn from a single data set.
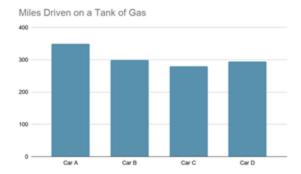
○ True

○ False

⋮⋮

Question 18 5 pts

Based on the following chart, which car gets the best gas mileage per gallon?

○ Car A

○ Car B

○ Car C

○ Car D

⋮⋮

Question 19 4 pts

According to the table, is there likely to be more traffic in the morning or in the afternoon?

Date	Time	Trip Duration
3/1/2021	8:00	45

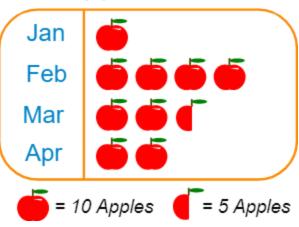|		
3/1/2021	16:00	41
3/2/2021	8:00	44
3/2/2021	16:00	37
3/3/2021	8:00	44
3/3/2021	16:00	46
3/4/2021	8:00	43
3/4/2021	16:00	38
3/5/2021	8:00	50
3/5/2021	16:00	44

○
Morning

○
Afternoon

○
Inconclusive

⠿

Question 20 5 pts

Which of the following would NOT be a conclusion that can be made from this pictograph?

Apples Sold

○

There were 95 total apples sold

○

The most apples were sold in February

○

The amount of apples sold stays consistent from month to month

○

Cold weather in January led to low apple sales

⋮⋮

Question 21 4 pts

Check all the following questions that could be answered regarding the previous pictograph.

☐

In what month were the most apples sold?

☐

What is the average amount of apples sold per month?

☐

What caused the apple sales to go down from February to April?

☐

When would apples have the highest price?

⋮⋮

Question 22 4 pts

If a line graph displaying the average home value shows that values have gone up over the last 2 years, it is safe to assume that they will keep rising over the next 2 years.
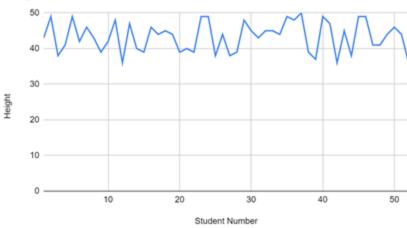
○

True

○

False

Question 23 5 pts

Based on the provided visualization, will the average student height go up or down over time?

Height vs. Student Number

○
Up

○
Down

○
Stay the same
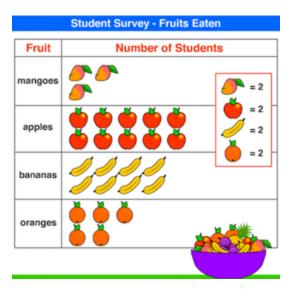
○
Inconclusive

Question 24 5 pts

Based on the following pictograph, which fruit should be purchased in the highest quantity for future school lunches?

○
Mangoes

○
Apples

○
Bananas

○
Oranges

Quiz saved at 10:46am   Submit Quiz