

ODU Data Center Test Scoring and Item Analysis

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Test Scoring and Item Analysis

The current version of Remark Classic OMR provides for the scoring of selection type tests that have been read from OPSCAN answer forms. The Data Center standardizes on Pearson Form 6703 or 4521; however custom forms can be created to suit any faculty needs. In addition to scoring a test and obtaining a test performance profile, the system provides a means of test analysis to identify poor or erroneous items. The instructor can use the information provided to improve test items for future use.

This new version of the Remark Classic OMR provides reports and data that will replace both **!Brilliant** and **!Excellent** post scoring processes that were used with the previous obsolete versions of Remark OPSCAN software. The Data Center can provide the OPSCAN results in a *.xlsx file format for faculty members that want to do post processing analysis of test data. !Brilliant and !Excellent will not function correctly with the output of the current version of Remark Classic OMR.

ITS will score tests submitted to the computer operations staff. Faculty should complete an Optical Scanner usage form at the pick-up window on the 4th floor of the E&CS Building. Any requested data files and program report output will be automatically emailed to the faculty ODU email account. A score transfer file can be created in your choice of comma-delimited Excel format (*.xlsx) or a Blackboard ready import format (*new feature*).

Test Scoring Options

This version of the Remark Classic OMR provides the functionality for a wide variety of scoring methodologies and uses. Most simple single answer key uses can be accomplished by the use of paper answer keys. Most of the advanced uses require the creation of an electronic answer key. Electronic answer keys can be created in two methods which are defined later in this document. In general, the following functionality is available in the Test Scoring system:

- **Multiple Correct Answers for a single question:** You allow more than one correct answer for a single test item. (paper, electronic key file or electronic answer keys)
- **Multiple Test Versions:** Multiple test forms can be used and scanned in one pass. (paper, electronic key file or electronic answer keys)
- **Weighted Questions:** Test items may be weighted to award different point values to test item or answers (requires an electronic answer key)
- **Multiple Answers for a single questions:** You may assign points to more than one correct answer for a single test item (requires electronic key file or electronic answer key)
- **Learning Objectives:** Subsets of items may be defined and a subset score output to reports (requires an electronic answer key)
- **Grading Scales:** Grading scales can be assigned to tests (requires an electronic key)
- **Scaled Scores:** a scaled score converts a student's score on a test to a common scale that will allow for comparison among students. (requires an electronic answer key)

Test Key Attributes

GENERAL PURPOSE - NCS PEARSON - ANSWER 5
SEE IMPORTANT MARKING INSTRUCTIONS ON SIDE 2

NAME (Last, First, M.I.)

SEX

BIRTHDATE

IDENTIFICATION NUMBER

SPECIAL CODES

Test Key Attributes

When using the OPSCAN forms the following best practices should be managed to achieve accurate testing results and management of desired scoring through the use of the Test Key Attributes:

- If you are using a single paper answer key, the answer key should be the first page (first item scanned) for any OPSCAN Scanner request. If an electronic key has been configured, it should be specified on the OPSCAN Scanner request to insure proper grading.
- The fields read from the OPSCAN forms include the NAME, SEX, BIRTHDATE, STUDENT ID, SPECIAL CODE and all the ITEM RESPONSE fields. Only the Name, Student ID, Special Codes and Response Items are used in scoring tests.
- The best practice for the NAME field is for Students to entire their names Left justified and complete all unused columns with BLANKS.
- Best practice is for students to enter their STUDENT ID numbers left justified; unused columns of the ID field can remain blank but should be filled with ZEROS. No validation of the ID field occurs to prohibit scoring a test.
- The KLMNOP Columns of the Special Code field are read and stored in the data but is not used for any scoring attributes.
 - However, the KLMNOP field is active and can be used side for Multiple Test versions. For example, you could have students enter a test form number in the KLMNOP field corresponding to the lab section or test version.
- For a single paper answer key test submission, only one answer may be marked in each student response answer form answer field (A thru E or A thru J) for a question.

- Questions left blank on the answer key are not graded.
- If the answer key has a test item response with multiple answers specified, the system will score all the student tests by treating the answers as an XOR operation (exclusive OR). This means that if a student provides EITHER one of the answers to the question it will be scored as a correct answer. If the student provides BOTH the answers or NEITHER answer the question will be scored as incorrect.
- If a student provides multiple answers to a question with a single response on the answer key the question will be scored as incorrect EVEN IF one of the students' responses was the correct answer.
- The student test file may be created from the standard 200 question 5-response (Pearson Form 4521) answer form or the 120 question, 10-response (Pearson Form 6703) answer form. The answer key is used to identify the form type by looking for an answer on the key with a response of F through J. Scoring a test using a 10-response form without a single answer keyed above the E distracter will have correct scores but incomplete item analysis if any students select an answer above E.

Identifying Paper Answer Keys

Paper answer keys can be used for the grading and management of the simplest forms of OPSCAN grading. Paper answer keys can be used for single test versions and multiple test versions. When using paper answer keys there is typically only one correct answer to each question. Any response items left blank are not graded. Multiple correct answers for a single question can be used as specified subject to the constraints specified in the Test Key Attributes section.

Paper test keys are identified by entering 10 zeros in the IDENTIFICATION NUMBER field. The name field is not functionally used on test keys and can be left blank. Or alternatively you could enter the word KEY left justified. When submitting multiple paper test answer keys the SPECIAL CODE field on each key should uniquely identify that key. Student response sheets will be graded based on the matching SPECIAL CODE field in the Answer key.

Identifying Electronic Answer Keys

The use of electronic answer keys is a new feature and allows for the use of additional functionality such as multiple test versions, customized point values, grade scales, designation of questions relating to Learning Objectives and the definition of Benchmarks for comparative reporting.

Faculty can schedule an appointment with ITS eLearning staff to come to the E&CS Data Center to create and save answer keys on the scoring system. Those answer keys would be used to grade tests as specified by the faculty member. The eLearning staff will work with and assist faculty members in configuring and testing their electronic answer keys. Use of scoring system configured electronic answer keys will allow for the use of all current functionality provided for in the Remark Classic OMR OPSCAN system as outlined earlier in the document under Test Scoring Options.

Test Result Reporting and Data Analytics

In providing data back to faculty members there are some basic assumptions being made to provide a baseline analytic for OPSCAN documents? These assumptions are as follows:

1. Any excluded or missing values in the testing data are listed as BLANK in all reports
2. The default grade scale being used to score tests is
 - a. A grade of A for all scores $\geq 90\%$
 - b. A grade of B for all scores $\geq 80\%$ but less than 2.a.
 - c. A grade of C for all scores $\geq 70\%$ but less than 2.b.
 - d. A grade of D for all scores $\geq 60\%$ but less than 2.c.
 - e. A grade of F for all scores $< 60\%$

Default Reports

After working with OPSCAN documents, the Data Center will run a standard set of grading and analysis reports against the submitted data. These reports will be output to a single *.pdf file and immediately emailed to the requesting faculty member. These reports will replace the !Brilliant output that was previously provided under the old version. An initial cover page that provides a student grade report will be provided back to the faculty member along with the used response forms. Any additional printed reports desired by the faculty member should be printed after they receive the report batch in their email. If OPSCAN response data has been requested in a Microsoft Excel format (*.xlsx) or a Blackboard export file, they will be also attached to the email with the default report set.

The information below details the reports that will be provided to faculty members. The following reports are provided to each faculty member when using the OPSCAN process. Reports denoted with an * are those available when scoring multi-version reports. Additional reports are available and can be requested individually when completing the OPSCAN usage form.

Scanned data and reports are not retained or maintained by the Data Center for any future use. Faculty should insure they keep any required reports or OPSCAN forms as necessary to document learning outcomes.

****Report 101 - Student Statistics Report***

The Student Statistics report provides the scores for all students in the class. Students are listed down the left side of the report in alphabetical order, followed by the Grade, Total, Percent, Z Score, T Score, ETS Score, Deviation IQ, Percentile, Correct, Incorrect and Missing data related to each students response

Student	Lists the student identified on the test. If you are using the Analysis Respondent IDs'
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	this information appears in the student column.
Grade	Displays the grade the student achieved based on the grade scale that was used during the time of process. This will be the default grade scale as noted above or a customized one if electronic keys were used.
Total	Displays the total score achieved by the student. The first number is the number of points the student received; the second number is the total number of possible points on the test.
Percent	Displays the percent score achieved by each student.
Z Score	Displays the Z Score, which indicates how many standard deviations a score is above or below the mean (symbolized by a + or -).
T Score	Displays the T Score, which is a converted Z Score used to convert scores that are negative, fractional or both. The T Score can be expressed as $10Z + 50$.
ETS Score	Displays the ETS Score, which is a converted Z score used to convert scores that are negative, fractional, or both. It is used by the Educational Testing Service and can be expressed as $100Z + 500$.
Deviation IQ	Displays the Deviation IQ, which is a converted Z Score used to convert scores that are negative, fractional or both. The Deviation IQ can be expressed as $15Z + 100$.
Percentile	Displays the percentile, which is the percentage of scores that are lower than the listed score.
Total	Displays the total number of objective points obtained on the test, followed by the total number of possible objective points for the test.
Correct	Displays the number of correct questions for that portion of the test.
Incorrect	Displays the number of incorrect questions for that portion of the test.
Missing	Displays the number of missing questions for that portion of the test.

****Report 103 - Class Frequency Distribution Report***

The Class Frequency Distribution report displays the breakdown of scores for an entire class. It also shows the mean score, the defined target benchmark and the benchmark difference, if applicable. If you have defined learning objectives in the Grade Wizard, a breakdown of scores on each learning objective is also displayed.

The table across the top of the report shows the Grades along with their corresponding Percent Scores and Raw Scores, and the Frequency of each grade. The Percent column shows the percentage of time that grade appears for the group of scores. The chart shows the Grade across the X-axis (bottom) and the Frequency of that grade along the Y-axis (left side).

****Report 104 - Test Statistics Report***

The Test Statistics Report displays descriptive statistics about the overall test as well as each learning objective, if applicable. The following information is available:

Score Data	Nr of Graded Items	Displays the number of items on the test that was graded.
	Total Pts Possible	Displays the total number of points on the test.

	Maximum Score	Displays the highest score from the graded tests.
	Minimum Score	Displays the lowest score from the graded tests.
Statistics	Mean Score	Displays the average score of all the graded tests.
	Mean percent Score	Displays the average percent score for all of the graded tests.
	Benchmark Score	Displays the benchmark percent score used for the test (if applicable).
	Range of Scores	Displays the distance between the highest and lowest score.
	Standard Deviation	A measure of dispersion of a set of the data from its mean. The more spread apart the data is, the higher its deviation. It is calculated by taking the square root of the variance.
	Variance	The amount that each score deviates from the mean squared (by multiplying it by itself).
Percentiles	Percentile (25 and 75)	Percentiles are the values that divide a sample of data into one hundred groups containing equal numbers of observations.
	Median Score	The median of the scores from the graded tests.
	Inter Quartile Range	The difference between the 75 th percentile and the 25 th percentile.
Confidence Intervals	Confidence Interval (1, 5, 95 and 99%)	A confidence interval gives an estimated range of values that is likely to include an unknown population parameter, the estimated range being calculated from a give set of sample data. If independent samples are taken repeatedly from the same population, and a confidence interval calculated for each sample, then a certain percentage (confidence level) of the intervals includes the unknown population parameter.
Test Reliability	Kuder-Richardson Formula 20	The formula measures test reliability and is an overall measure of internal consistency. A higher value indicates a stronger relationship between items on the test.
	Kuder-Richardson Formula 21	This formula measures test reliability and is an overall measure of internal consistency. A higher value indicates a stronger relationship between items on the test.
	Coefficient (Cronbach) Alpha	A coefficient that describes how well a group of items focuses on a single idea or construct.

Report 105 – Student Response Report

The Student Response Report provides a class view of all test responses by student and by question. The students are listed down the left side of the report. The questions are listed across the top of the report. Each student's answer to each graded question is listed within a colored box: green for correct responses and red for incorrect responses. A white empty box means the student left the question blank or the response is invalid (e.g., multiple responses were entered when not allowed). To the far right of the report total score, percent score, grade and scaled score (if applicable) are listed. At the bottom of the report the percentage of students who answered the question correctly is listed, as well as averages for the total score, percent score, and grade. This report provides visual insight to both student and question performance.

Report 106 - Condensed Test Report

The Condensed Test report provides a summary of basic tests statistics. The header optionally contains statistical information about the test results as a whole. The body of the report shows each question, its response frequency, distractor information, group responses and the point biserial calculation.

Total Possible Pts	Displays the total number of points possible on the test.
Total Students	Displays the total number of students who submitted responses to the test.
Standard Deviation	A measure of the dispersion of a set of data from its mean. The more spread apart the data is, the higher the deviation. It is calculated by taking the square root of the variance.
Median Score	The middle of a distribution: half the values are above the median, and half are below the median.
Mean Score	Displays the average score of all the graded tests.
Reliability Coefficient (KR20)	This formula measures test reliability and is an overall measure of the internal consistency. A higher value indicates a stronger relationship between items on the test.
Maximum Score	Displays the highest score from the graded tests.
Minimum Score	Displays the lowest score from the graded tests.
Range of Scores	The range is the distance between the highest and lowest scores.
No.	Displays the number of items from the test.
Question	Displays the question text for the question as defined in the form template.
Correct answer	Displays the correct answer for each question, as obtained from the answer key.
Response Frequency	Displays the percentage or total number of times a particular answer choice was chosen by students for this particular question.
Non-Distractor	Displays the answer choices that were not selected at all by the students.
Correct Group Responses	The total % column displays the percentage of students who answered the question correctly. The Upper 27% column displays the percentage correct for the individual question based on the students who scored in the upper 27% for the test as a whole. The lower 27% column displays the percent correct for the individual question based on the students who scored in the lower 27% for the test as a whole.
Point Biserial	A measurement of the discrimination of an item. It indicates the relationship between a response for a given item and the overall test score of the respondent. The point biserial tells you if a question was a good discriminator between the better students and the poorer students. Point biserial ranges from -1 to 1. A positive value indicates that the students who did well on the test answered the question correctly.

Report 201 - Detailed Item Analysis Report

The Detailed Item Analysis report provides an in-depth look at individual question statistics. Each question displays in a separate table. The question text (or question name if no question text was defined in the form template or Grade Wizard) is displayed at the top of each table. A graph of the frequency appears to the right of the table.

Response	Displays the labels (answer choices) designated in the questions properties
Frequency	Displays the number of times a particular answer choice was chosen by students for this particular question.
Percent	Displays the corresponding percentage of the frequency.
Point Biserial	A measurement of the discrimination of an item. It indicates the relationship between a response for a given item and the overall test score of the respondent. The point biserial tells you if a question was a good discriminator between the better students and the poorer students. Point biserial ranges from -1 to 1. A positive value indicates that the students who did well on the test answered the question correctly.
Missing	Missing values are anything that is not valid data, such as a blank response.
Total	Displays the total number of valid responses and corresponding percentages. If you are including missing values, the total number missing is included in the total.
Objectives	Displays any Learning Objectives defined that utilize the question.

Optional Reports

The following reports are available as optional and can be requested at the time when the OPSCAN Usage form is completed when dropping off the request. Some reports are not available depending on the type of test submitted (multi-version, scaled etc).

Report 102 - Comparative Grade Report

The Comparative Grade Report allows you to see test scores broken down by specific criteria. You can select questions from the data on which to base the report. For example, this report is especially useful for comparing demographic groups. If your students mark a category such as ethnicity on their test answer sheet, you can view the data by ethnic group.

Report 107 – Demographic Grade Report

The Demographic Grade Report allows you to see test scores broken down by specific criteria. You can select questions from the data on which to base the report. For example, this report is especially useful for comparing demographic groups. If your students mark a category such as ethnicity on their test answer sheet, you can view the data by ethnic group. This report is very similar to the Comparative Grade Report, but is displayed in table format as opposed to hierarchical format.

Report 111 – Class Learning Objectives Report

The Class Learning Objectives report provides the average score for the overall test and each learning objective defined in the Grade Wizard. Objectives are listed down the left side of the report, and then the grade, total score and percent score are listed for each learning objective. If a scaled score is defined, it can also be displayed. If one or more subjective questions are included, the subjective total score is displayed. If a benchmark score was defined, the benchmark difference graph can be displayed.

Report 203 - Item Analysis Graph Report

The Item Analysis Graph Report contains similar graphs to those displayed in the Detailed Item Analysis and limited information pertaining to each graph. This report is a simplified version of the Detailed Item Analysis and provides a good way to view or export just the graph information. You may optionally show the Responses and Frequency Percent's that are used to generate the graphs.

Report 204 - Condensed Item Analysis Report

The Condensed Item Analysis report displays the same information from the Detailed Item Analysis report but in a condensed fashion. The question text (or question name if no question text was defined) is displayed at the top of each table. A bar chart is displayed to the right of the table containing the statistics. The bar chart displays the correct response(s) in green and the incorrect response(s) in red. If an incorrect response is chosen more than the correct response(s), its bar chart is yellow.

Report 207 - Test Item Statistics Report

The Test Item Statistics report displays descriptive statistics for each question on the test.

Report 208 - Crosstabulation Report

The Crosstabulation report generates a table displaying the number of cases falling into each combination of the categories of two or more categorical variables. Crosstabulation is a method of examining the relationships among variables that are at the nominal or ordinal level. The categories of one variable are listed in the rows and of a second variable in the columns. You choose specific questions from your data to use in the crosstabulation. The frequencies displayed in the Crosstabulation report can be totals or percent's. The correct answer for each question is marked with an asterisk. Please note that questions that allow more than one response cannot be used for crosstabulations.

Report 301 - Student Grade Report

The Student Grade Report provides a detailed grade report for each student included in the grade operation. You may print these reports and give them to your students, parents or other stakeholders. The report provides a summary of the students' answers and grade information from the test. If a benchmark score was defined using the Grade Wizard, you may include a bar chart depicting the student's score along with the benchmark. If learning objectives were defined using the Grade Wizard, you will see scores for each learning objective in addition to the overall test. Incorrect responses are highlighted in yellow.

Report 401 - Response Report by Item

The Response Report by Item displays all answers given to a question or questions on the form. By default, any questions that are not graded or tabulated in the form template or Grade Wizard can be included on the Response Report by Item. You can choose from all questions, regardless of whether they are graded or tabulated, by adjusting the report properties. This report is useful for displaying data from Input regions so that you can see how your respondents responded to write-in questions. For Input regions, you will see the text you entered into the data grid. The Response Report by Item will be

grouped by question (i.e. you will see the question and then the respondents' responses). You may choose whether to include an Analysis Respondent ID with the responses in the report properties.

Report 402 - Response Report by Respondent

The Response Report by Respondent displays respondents' answers to the questions on the form. By default, any questions that are not graded or tabulated on the form can be included on the Response Report by Respondent. You can choose from all questions, regardless of whether they are graded or tabulated, by adjusting the report properties. This report is useful for displaying data from Input regions so that you can see how your respondents responded to write-in questions. For Input regions, you will see the text you entered into the data grid. The Response Report by Respondent will be grouped by respondent (i.e. you will see the respondent listed first and then that respondent's responses for all selected questions).

Using the OPSCAN for Survey Items

The OPSCAN forms can be used to provide counts for students responding to **un-keyed** items. This feature may be used for a survey. OPSCAN forms used for a survey are processed without a key, and report information and data files will be sent via email to the faculty member for analysis.

When OPSCAN forms are used for processing survey data some key attributes contained on the standard OPSCAN forms 4521 and 6703 are ignored during tabulation while others are tabulated and compiled along with the responses. The NAME and STUDENT ID attributes are ignored while other key attributes including SEX, BIRTHDATE and GRADE or EDUC are included in the survey tabulation.

If desired by the faculty member, a Microsoft Excel data file (*.xlsx) will be provided for further data analysis in addition to the following reports. The following reports will be merged into a single *.pdf file and emailed to the faculty's ODU email address.

Report 204 – Condensed Item Analysis Report

The Condensed Item Analysis report displays detailed information concerning each question with a corresponding bar chart to the right. The following information is provided for each response item in the survey:

Question	Displays the question text or question name if no text was defined
Responses	Displays the labels (answer choices) designated in the form template
Frequency	Displays the number of times a particular answer choice was chosen by respondents for this particular question.
Percent	Displays the corresponding percentage of the total.
Missing	If there are missing values in your data set the total and corresponding percent are displayed for each question displaying missing values is controlled in the Remark Quick Stats Preferences.
Mean	Displays the mean calculation for the question based on values defined in the form

	template.
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Report 206 – Item Statistics Report

The Item Statistics report displays descriptive statistics for each question in the survey tabulation operation. The following table summarizes these statistics:

Item	Displays the question name or question text (if provided).
Sample Size	Displays the valid number of respondents who answered the specific question.
Missing & NA	Displays the number of responses that are missing (blank, multi, etc)
Mean	The average of the values in the population.
Variance	The mean of the squared deviation of a variable from its expected value or mean. The variance is a measure of the amount of variation within the values of that variable, taking account of all possible values and their probabilities or weightings.
Standard Deviation	A measure of the dispersion of a set of data from its mean. The more spread apart the data is, the higher the deviation. It is calculated by taking the square root of the variance.
Standard Error	The standard deviation of the sampling distribution of that statistic. Standard errors reflect how much sampling fluctuation a statistic will show.
Minimum	The minimum value in the range.
Maximum	The maximum value in the range.
Range	The distance between the maximum and minimum.
Skewness	A measure of the symmetry or lack of it in a set of data as evident from the shape of the distribution. A distribution is symmetric if left half of the graph of the distribution is the mirror image of the right half. If a distribution is skewed to the right (positive skewness) the mean is greater than median, which in turn is greater than the mode, in which case the skewness coefficient is greater than zero. If a distribution is skewed to the left (negative skewness) then the relationship is reversed; in which case the coefficient is less than zero. If there is no skewness or the distribution is symmetric like the bell-shaped normal curve then the mean = median = mode.
Kurtosis	Kurtosis is based on the size of a distribution's tails. Distributions with relatively large tails are called "leptokurtic"; those with small tails are called "platykurtic." A distribution with the same kurtosis as the normal distribution is called "mesokurtic."
T-Value	A measure on a random sample (or pair of samples) in which a mean (or pair of means) appears in the numerator and an estimate of the numerator's standard deviation appears in the denominator. The latter estimate is based on the calculated s square or s squares of the samples. If these calculations yield a value of (t) that is sufficiently different from zero, the test is considered to be statistically significant.
Mean Absolute Deviation	A measure of variation, which calculates the average distance a data value is from the mean.
Percentile	Percentiles are values that divide a sample of data into one hundred groups

(25 & 75)	containing (as far as possible) equal numbers of observations. For example, 25% of the data values lie below the 25th percentile.
Median	The middle of a distribution: half the values are above the median and half are below the median.
Inter Quartile Range	The difference between the 75th percentile and the 25th percentile.