ME 274 Fundamentals Exam Summary Report: Spring 2018*

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Overall Performance

Table 1 lists the descriptive statistics for your students' total scores (the total number of questions correct).

Table 1: Summary Statistics for Overall Number of Questions Correct

	Mean	Median	Minimum	Maximum	1st Quartile	3rd Quartile
All Sections	8.36	8.00	6.00	11.00	7.00	9.50
Section 1	8.00	8.00	7.00	9.00	7.50	8.50
Section 2	8.00	8.00	6.00	10.00	7.00	9.00
Section 3	8.33	8.00	7.00	10.00	7.50	9.00
Section 4	9.00	9.00	7.00	11.00	8.00	10.00

Performance By Question

Table 2 details the proportion of correct responses for each question on the assessment.

Table 2: Proportion of Students That Answered Question Correctly

	Section				
	All	1	2	3	4
Q3. Cross Product: Conceptual	0.91	1.00	0.67	1.00	1.00
Q10. Vector Projection: Coord. System	0.91	1.00	0.67	1.00	1.00
Q1. Speed Time History	0.82	0.50	1.00	1.00	0.67
Q4. Free Body Diagrams	0.82	0.50	0.67	1.00	1.00
Q7. Cross Product: Calculation	0.82	1.00	0.67	0.67	1.00
Q11. Vector Projection: Rotated Coord. System	0.82	1.00	0.67	0.67	1.00
Q8. Friction	0.73	0.50	0.67	1.00	0.67
Q6. Vector Projection: Unit Vector	0.64	1.00	0.67	0.33	0.67
Q12. Moments	0.64	1.00	0.67	0.33	0.67
Q2. Kinetic Energy Time History	0.55	0.00	1.00	0.67	0.33
Q9. FBD and Multibody Systems	0.55	0.00	0.67	0.67	0.67
Q5. Chain Rule	0.18	0.50	0.00	0.00	0.33

*The source code that produced this report accompanied a journal manuscript that is in review. For more details on how to prepare and interpret the results in this report, please watch for the journal article to be published.

How Did Your Students Answer the Questions?

This section details how your students answered each of the questions. The "item response curves" (IRCs) show how students with different overall test scores answered the questions.

How to Read the IRC Plots

Top Plot: Histogram of Total Scores

The top plot is a histogram of the students' total test scores. It is repeated above every IRC for easy reference. The information in the IRC is most reliable for the total test scores that students earned most frequently because the information is averaged over many students. Thus, the information in the IRCs for the extreme scores is less reliable than the information near the median score.

Bottom Plot: IRCs

The IRC plots should be read vertically for each total score. In other words, for a given total test score, instructors should read vertically to see what proportion of students with that score selected a given answer choice.

However, the pattern of the proportion of a given answer option across total test scores can also be insightful.

- Ideally, the correct answer should draw an 's-shaped' curve when viewing the responses from lowest to highest total score. This s-shaped curve indicates that the item clearly discriminates between those who understand the concept and those who do not, and it also likely reflects the validity and clarity of the question.
- IRCs for incorrect answers that look like inverted s-curves (higher for low scores and curving down to no responses for high scores) indicate high-functioning distractors. These answers probably correspond to common misconceptions about the topic being assessed.
- Answer options that were chosen infrequently across all total test scores are low-functioning distractors because students do not consider them viable answers. You may want to revise or replace these answer choices.

Example: Suppose answer "C" was a popular choice for lower-performing students, and answer "B" (the correct answer) was popular with higher-performing students. This scenario may imply that answer "C" is a common misconception that the instructor may want to address in class.

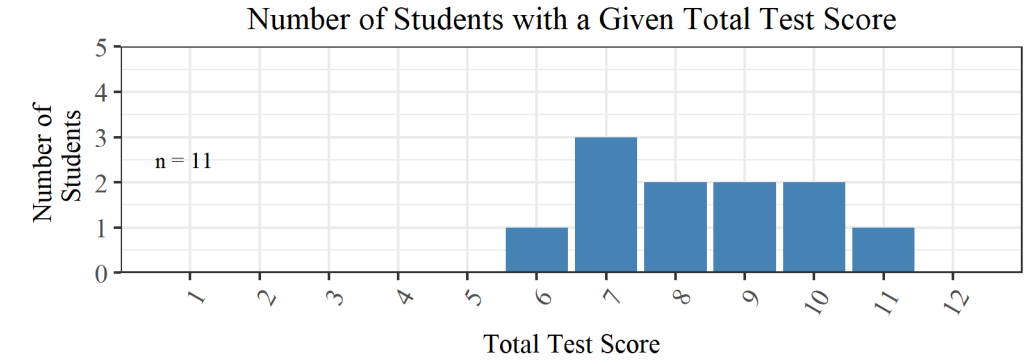
Summary and More Information

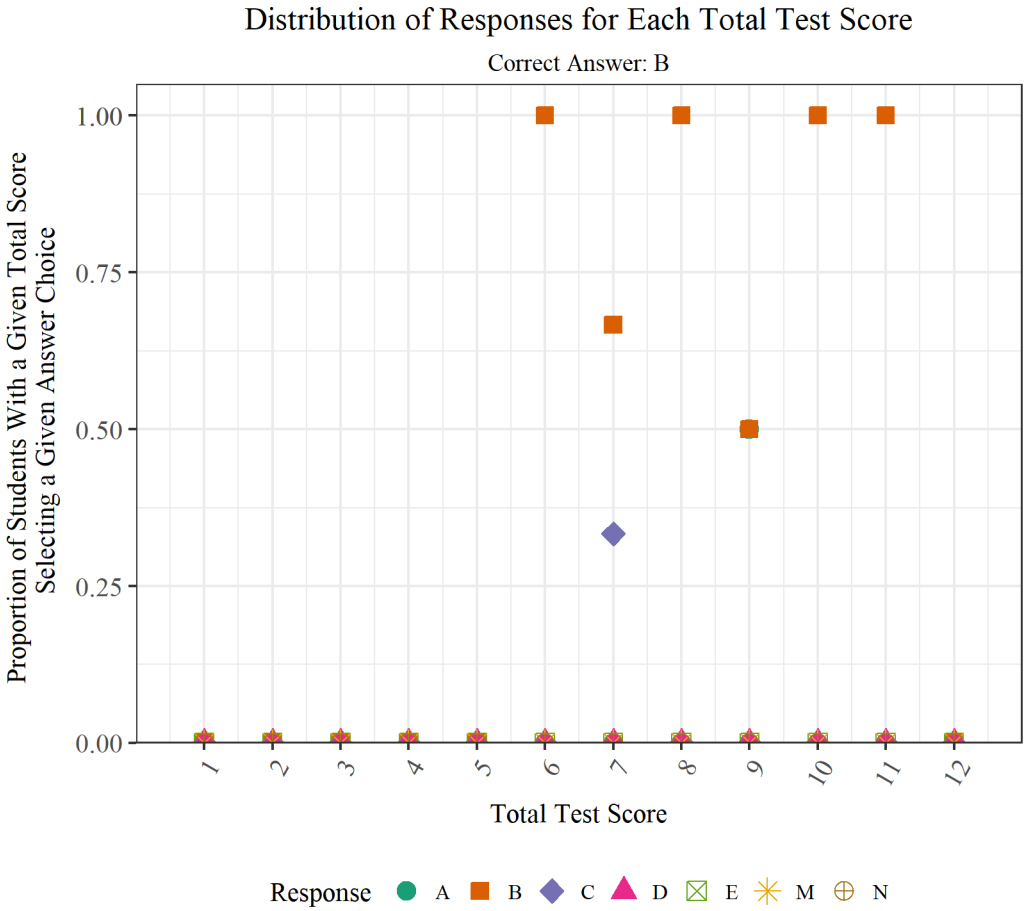
In summary, instructors can quickly look at the IRC patterns of: (i) lower-performing students to better understand what misconceptions the students may be harboring, and (ii) higher-performing students for evidence of question validity.

More information can be found in the following references:

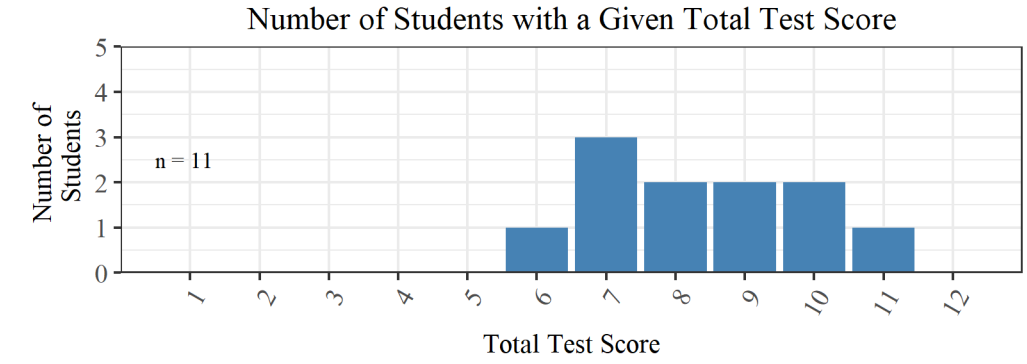
- Morris, G. A., Harshman, N., Branum-Martin, L., Mazur, E., Mzoughi, T., & Baker, S. D. (2012). An item response curves analysis of the Force Concept Inventory. *American Journal of Physics, 80*(9), 825-831. doi:10.1119/1.4731618
- Morris, G. A., Branum-Martin, L., Harshman, N., Baker, S. D., Mazur, E., Dutta, S., . . . McCauley, V. (2006). Testing the test: Item response curves and test quality. *American Journal of Physics, 74*(5), 449-453. doi:10.1119/1.2174053

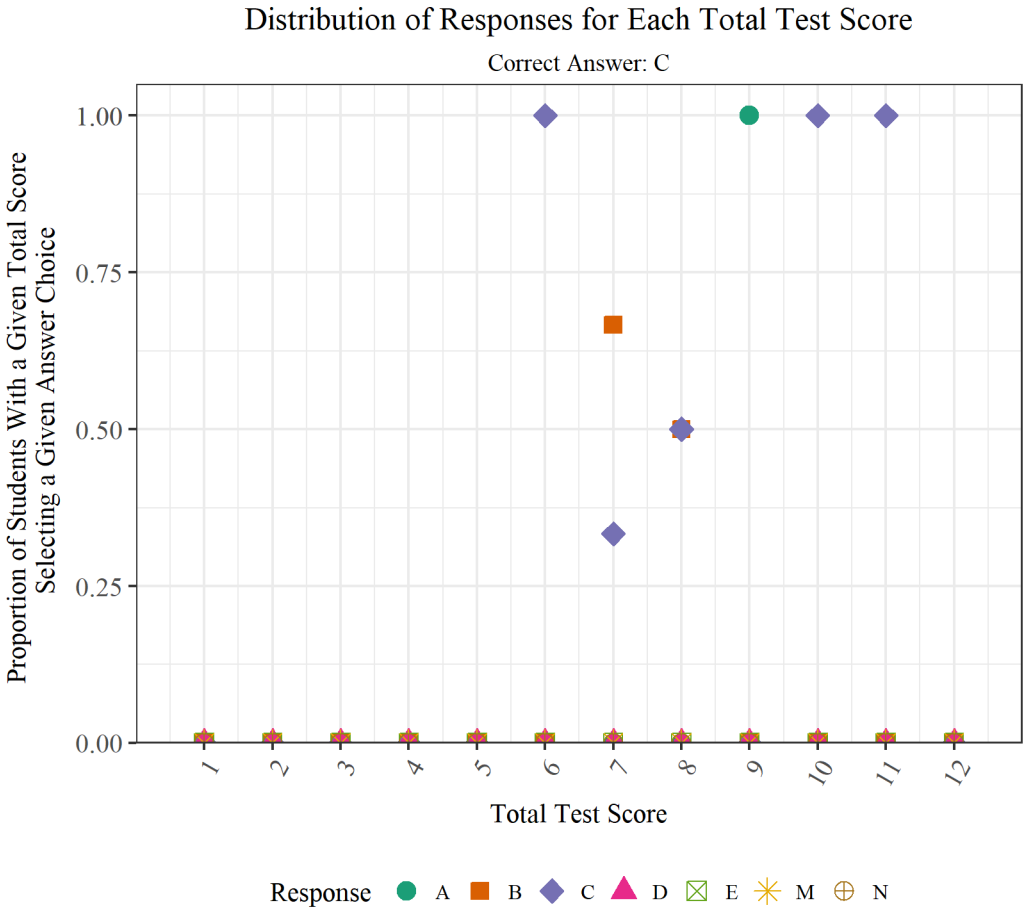
Q1. Speed Time History



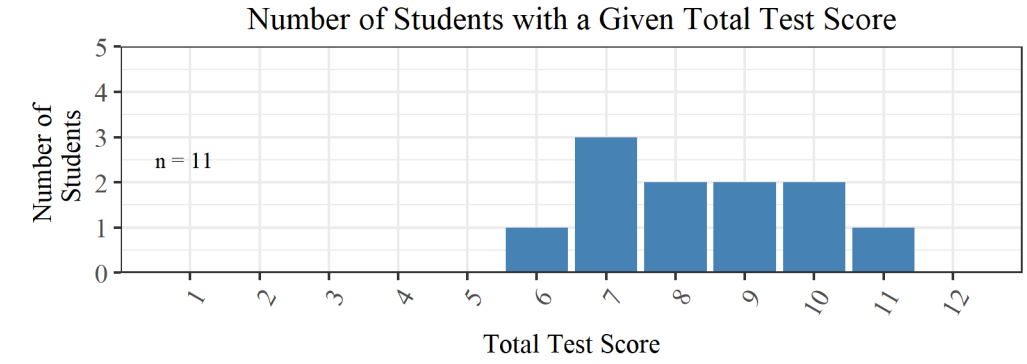


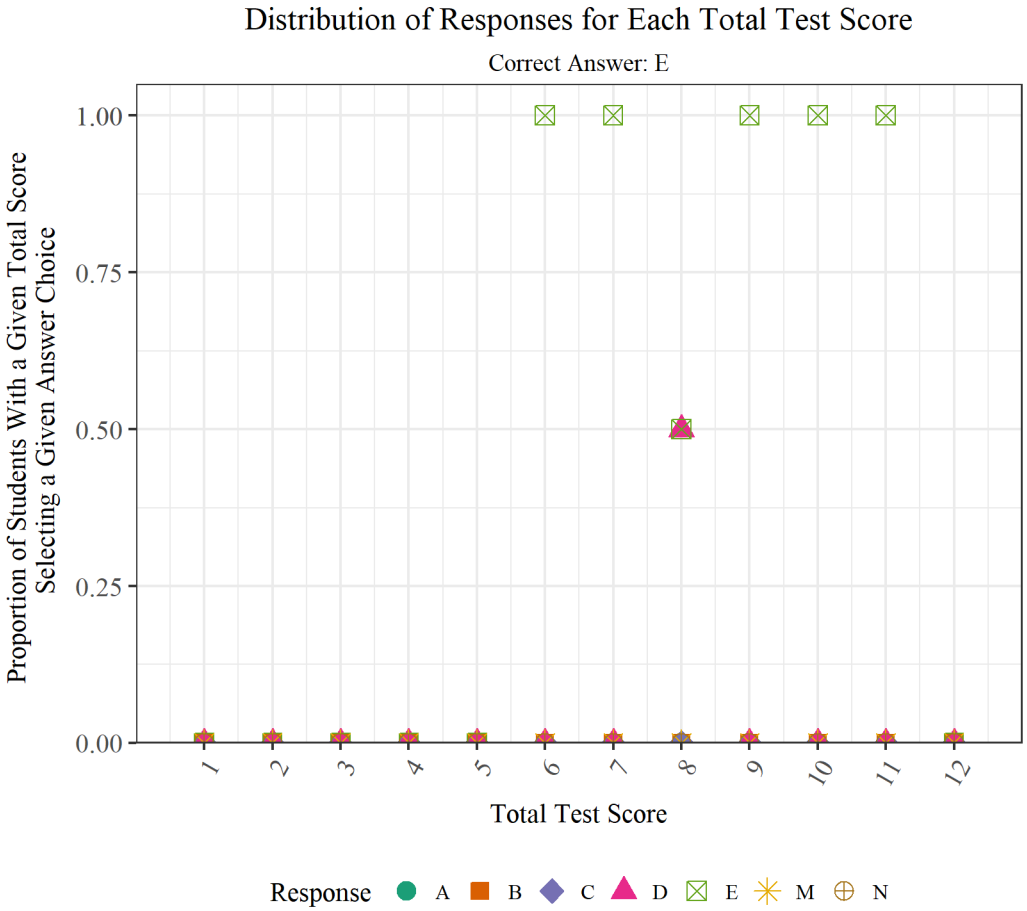
Q2. Kinetic Energy Time History



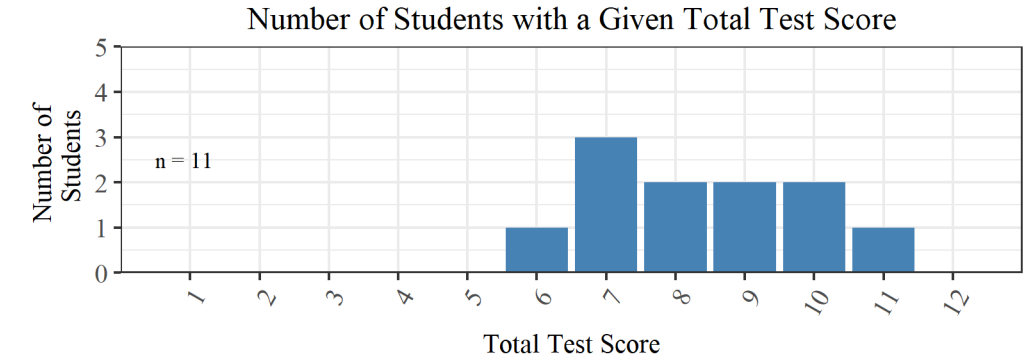


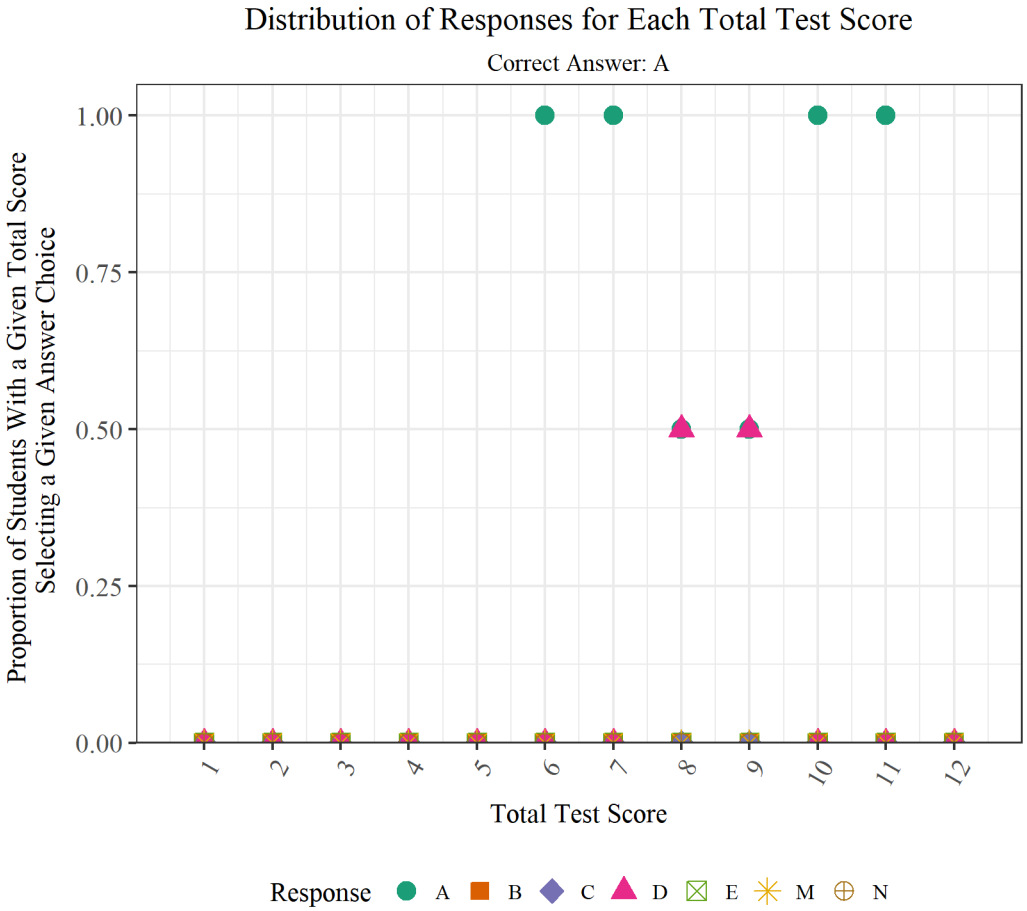
Q3. Cross Product: Conceptual



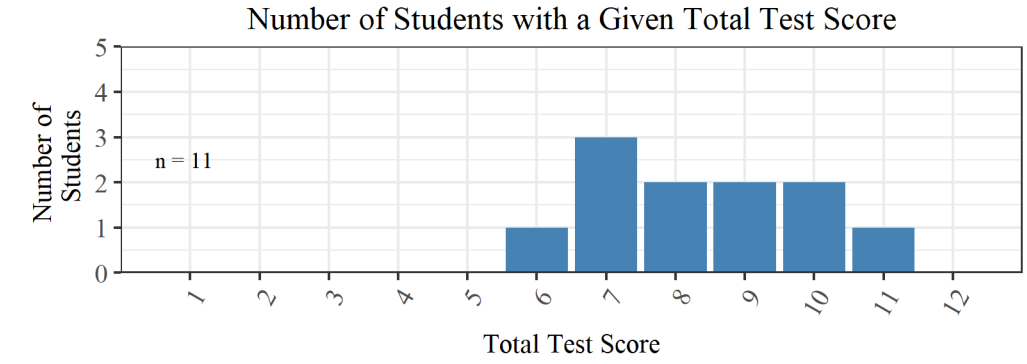


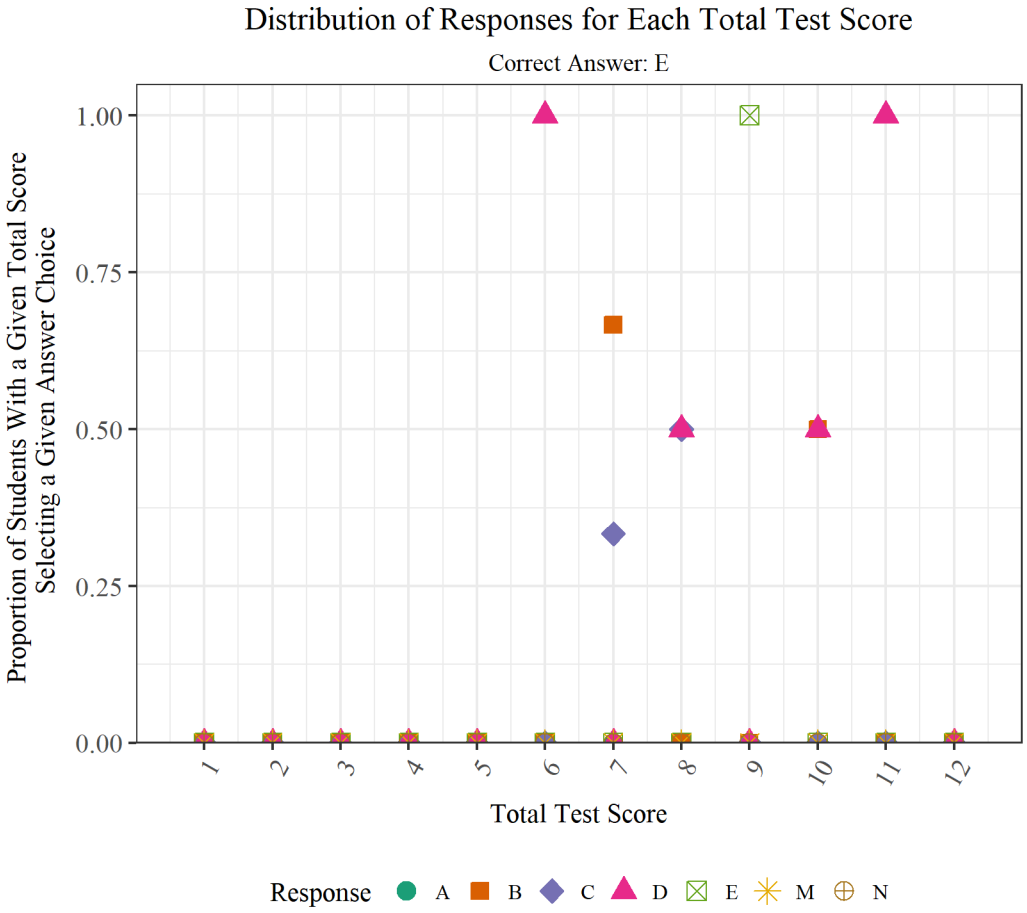
Q4. Free Body Diagrams



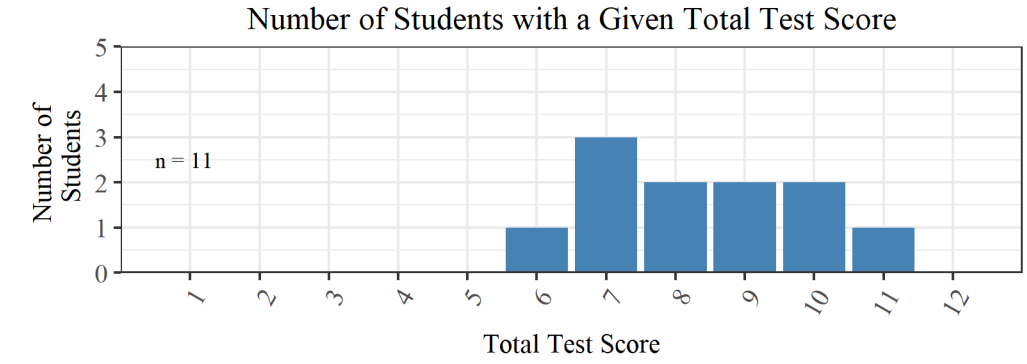


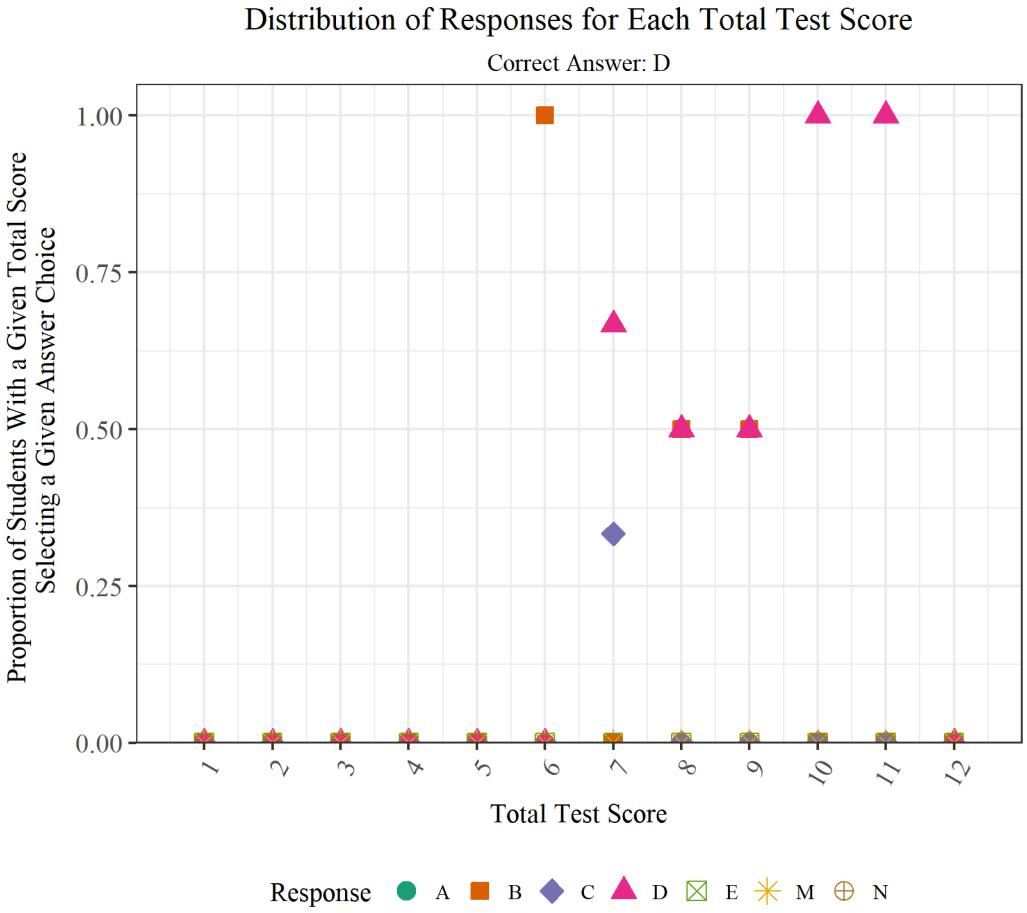
Q5. Chain Rule



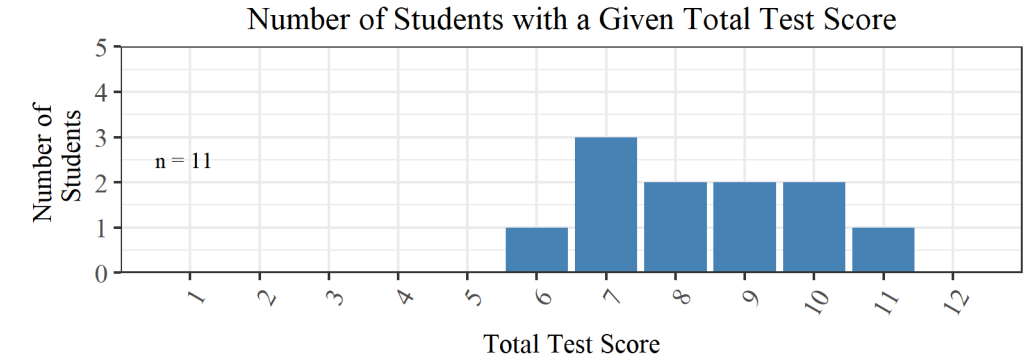


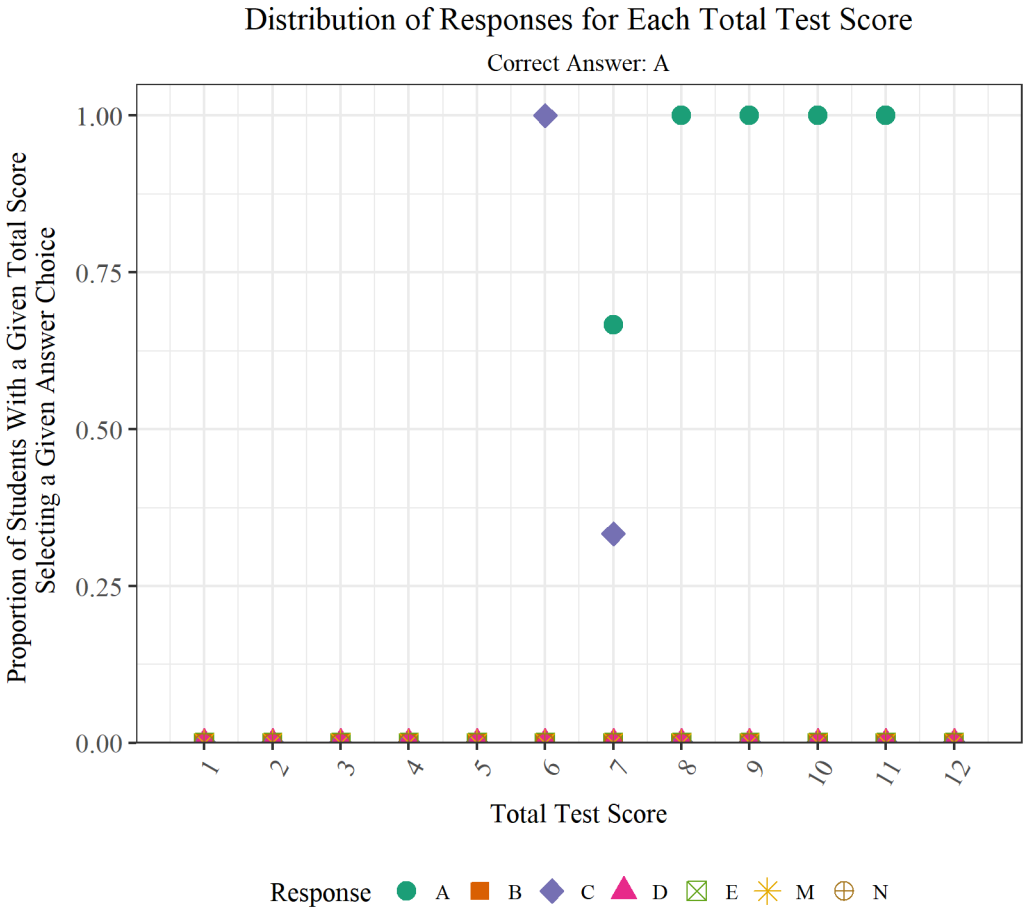
Q6. Vector Projection: Unit Vector



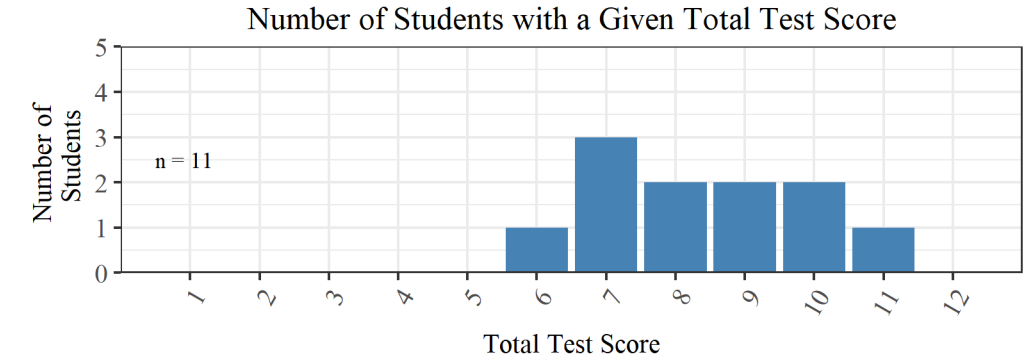


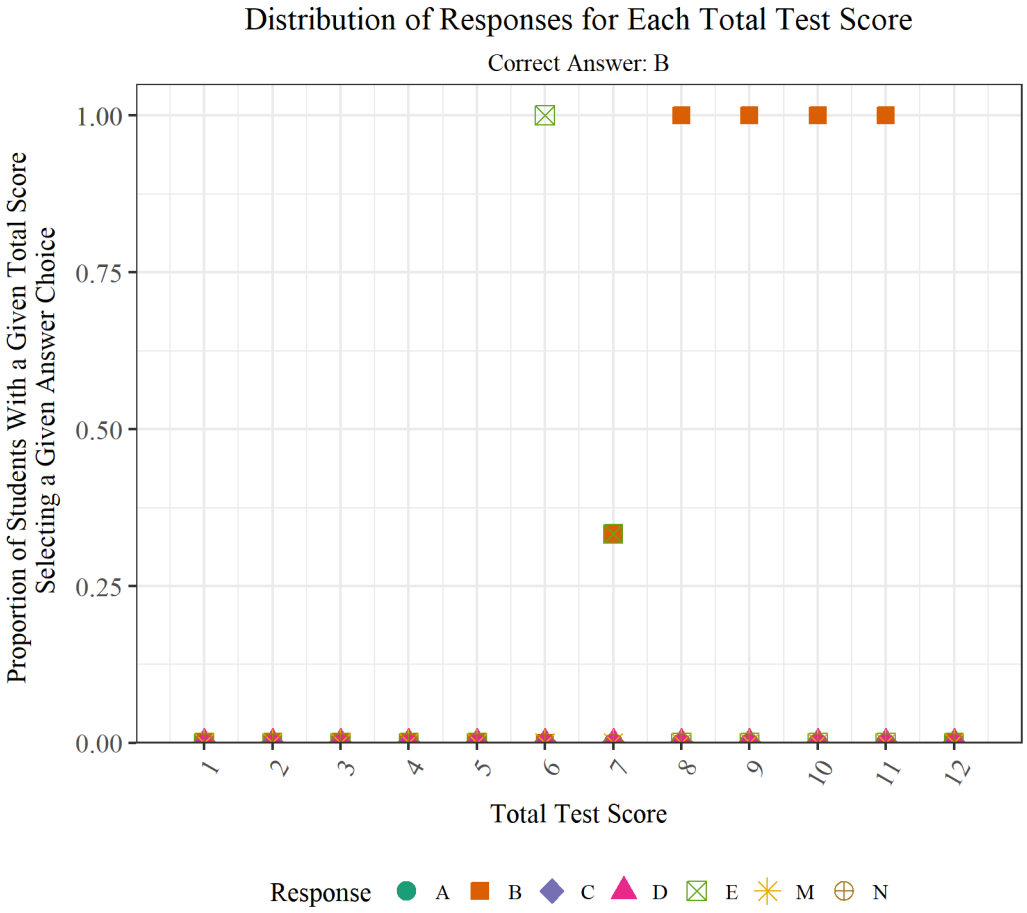
Q7. Cross Product: Calculation



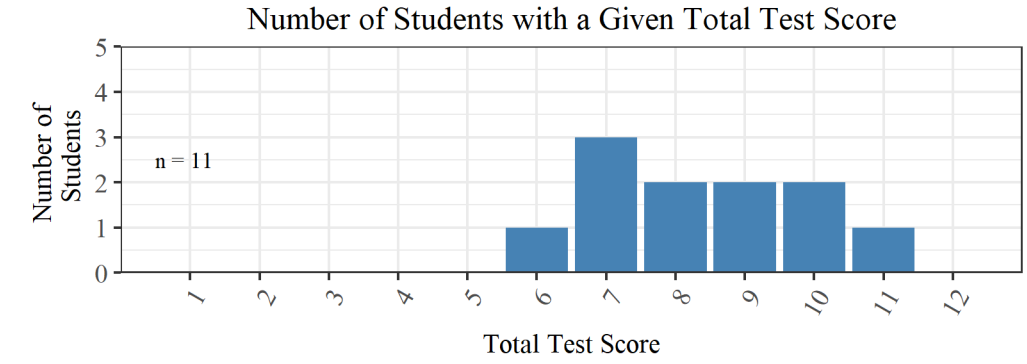


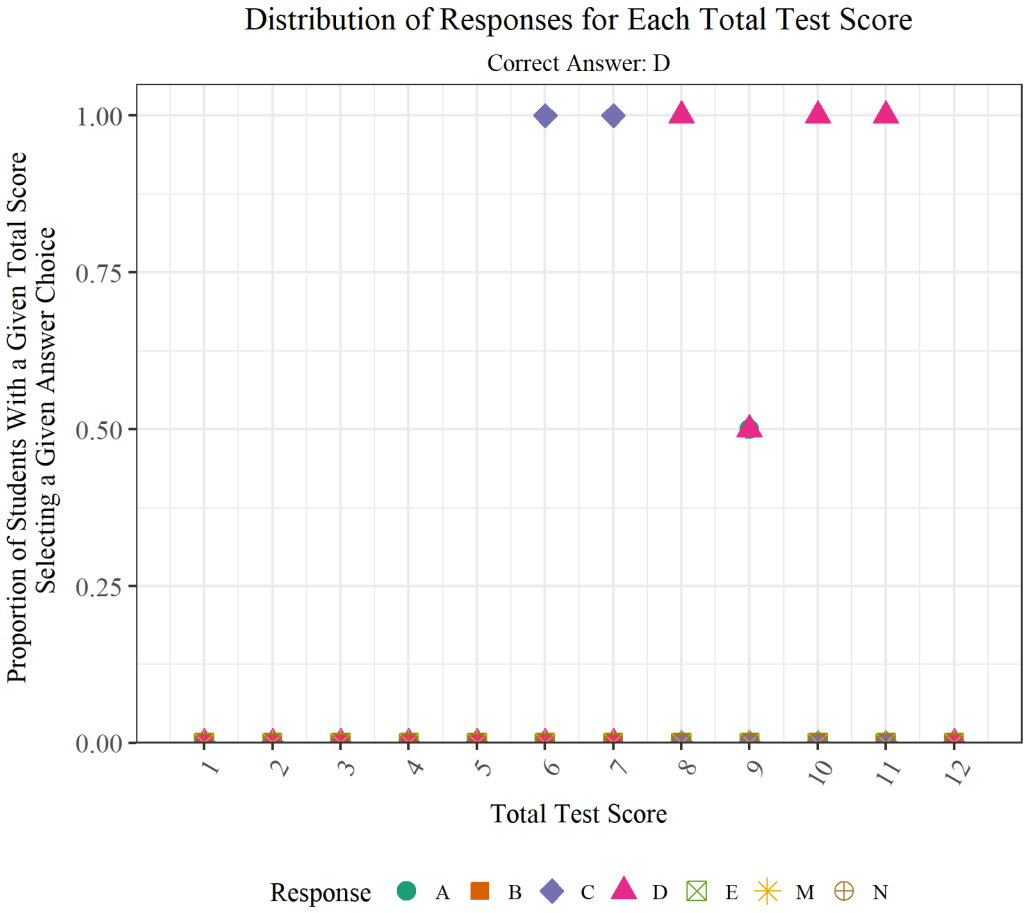
Q8. Friction


Number of Students with a Given Total Test Score
Number of Students
n = 11
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
10
11
12
Total Test Score

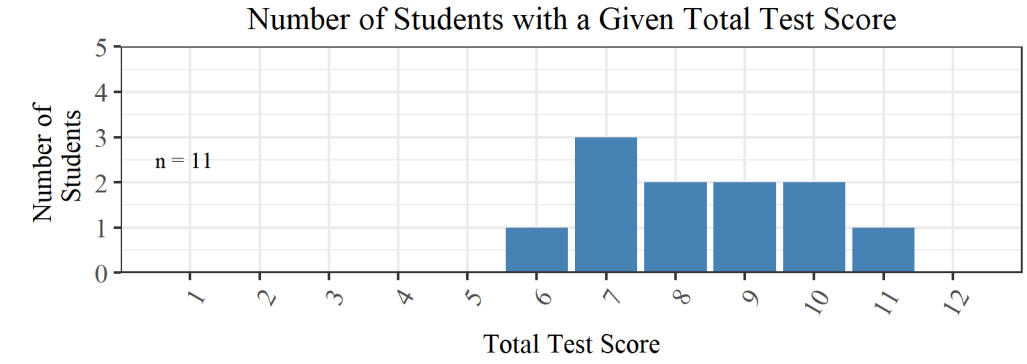

Distribution of Responses for Each Total Test Score
Correct Answer: B
Proportion of Students With a Given Total Score Selecting a Given Answer Choice
0.00
0.25
0.50
0.75
1.00
1
2
3
4
5
6
7
8
9
10
11
12
Total Test Score
Response
A
B
C
D
E
M
N

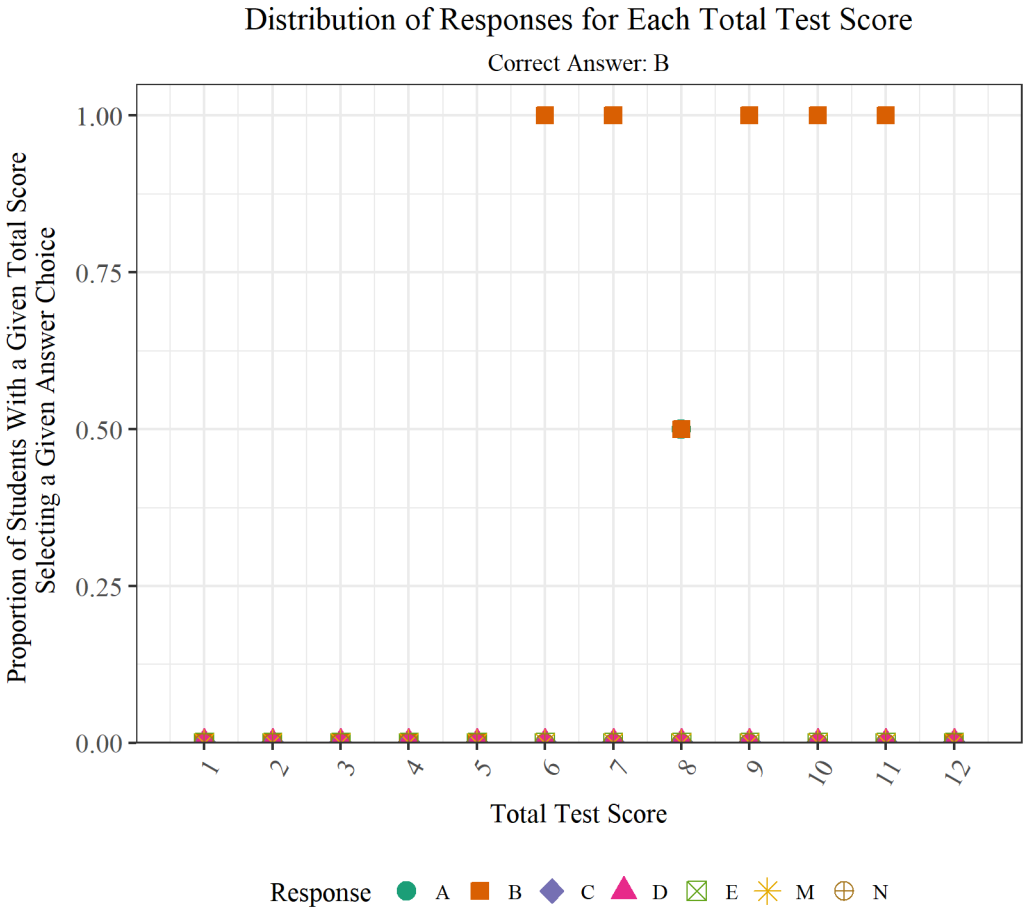
Q9. FBD and Multibody Systems



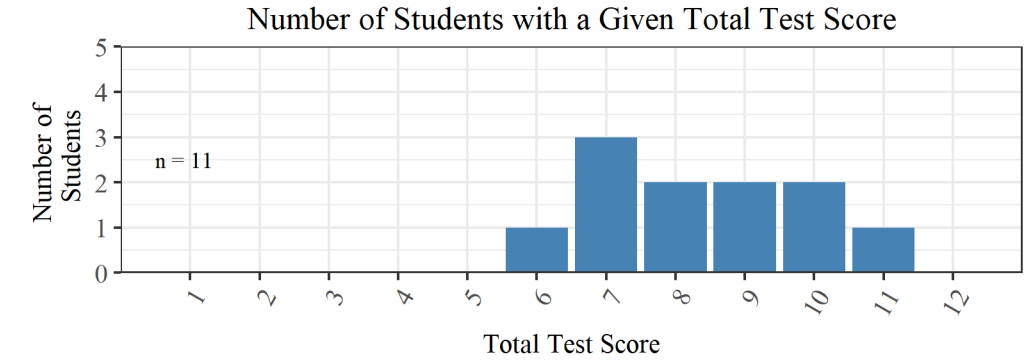


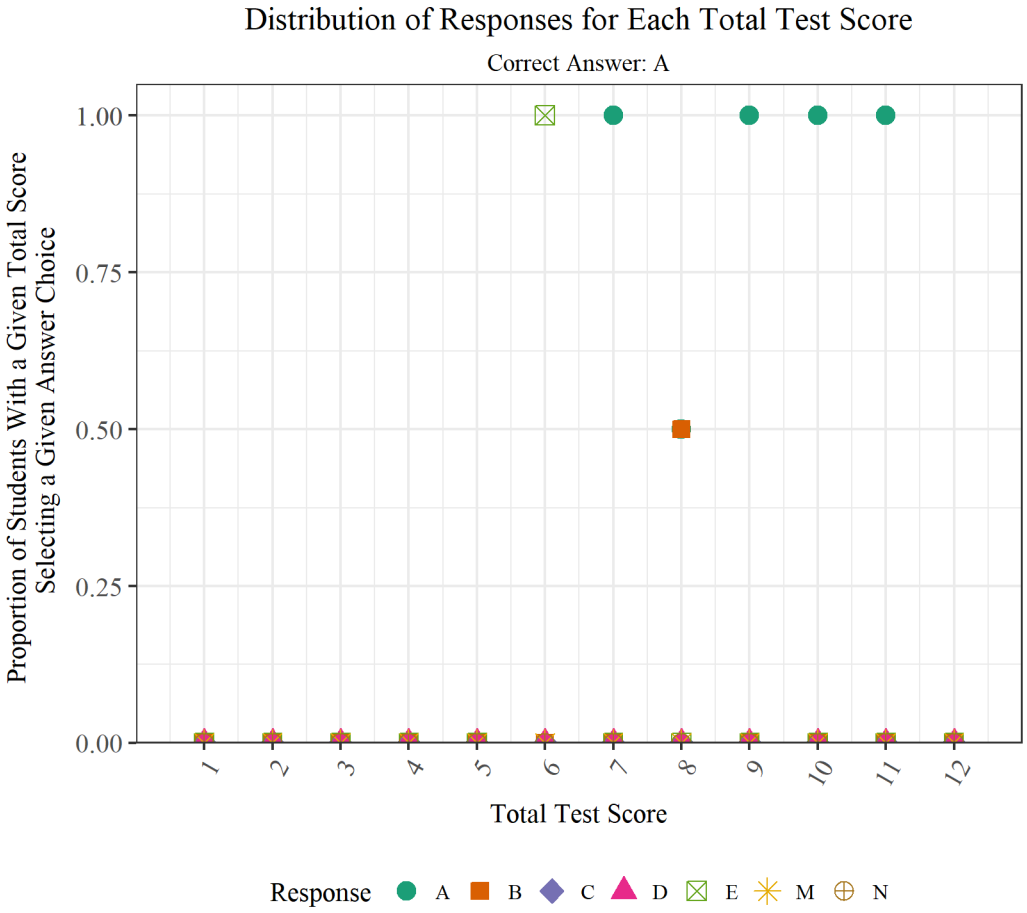
Q10. Vector Projection: Coord. System



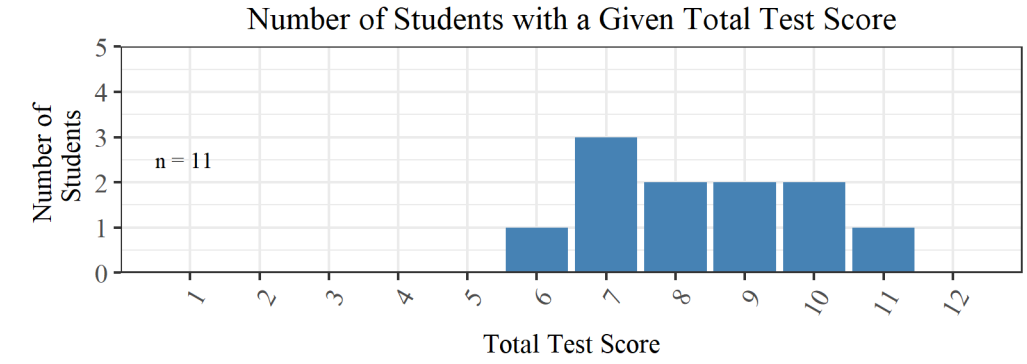


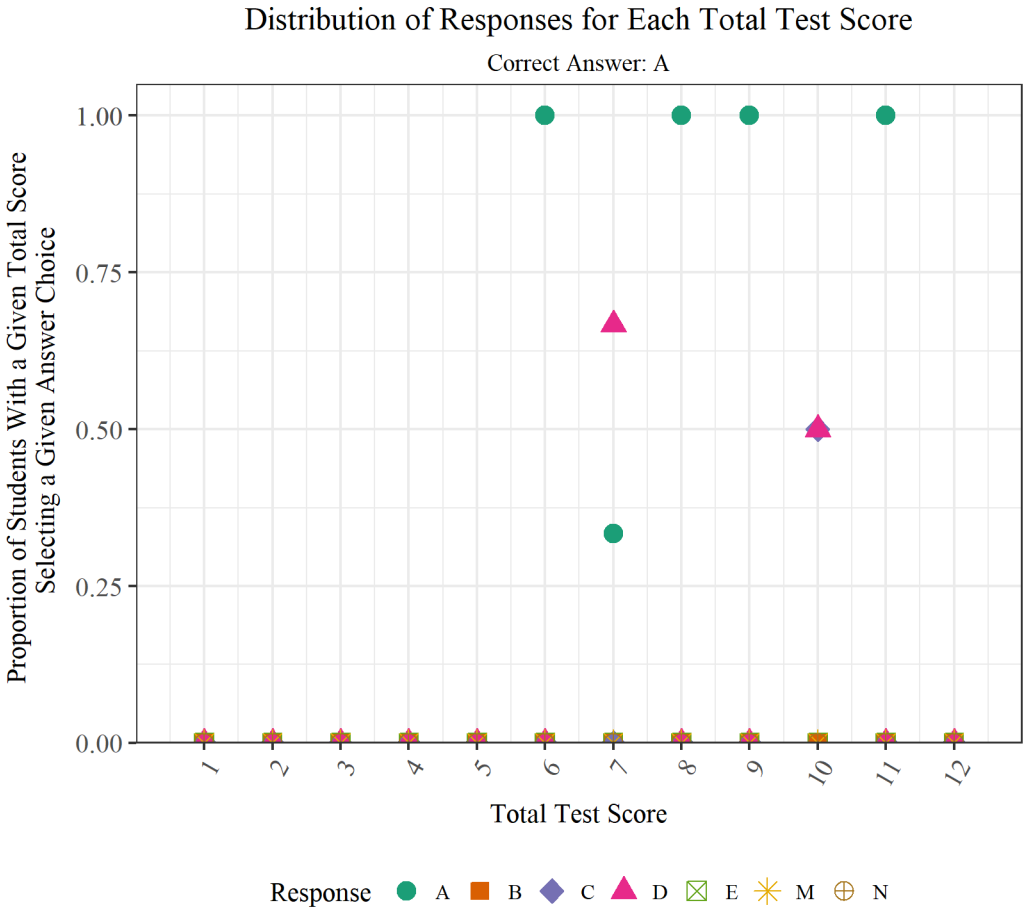
Q11. Vector Projection: Rotated Coord. System





Q12. Moments


Number of Students with a Given Total Test Score
Number of Students
n = 11
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
10
11
12
Total Test Score


Distribution of Responses for Each Total Test Score
Correct Answer: A
Proportion of Students With a Given Total Score Selecting a Given Answer Choice
0.00
0.25
0.50
0.75
1.00
1
2
3
4
5
6
7
8
9
10
11
12
Total Test Score
Response
A
B
C
D
E
M
N