

ECE 331 Knowledge Probe – Spring 2008

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ABET Outcomes probed: A, B, C.

Relevant pre- and co-requisite classes: ECE 131 and 231, ECE 340, Math 327

1. Instrument

The knowledge probe (KP) consisted of a five questions given to students in the class during the last week of the semester. The class was taught by Ms. Honggang Yu. Students were given thirty minutes to answer the questions. The KPs returned by the students are attached.

Question 1

This question was meant to address outcome A. In particular, this question was meant to determine if students have a very basic knowledge of probability theory. The question involves computing the expected value of the outcome of a random experiment. The knowledge necessary to answer the question should have been gained (at the very least) in ECE 340 (a course co-requisite). *A priori*, I expected 95% of the students to answer this question correctly.

Question 2

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in Math 327 (a course prerequisite). Specifically, this question dealt with basic combinatorics, and expected 75% of the students to get both parts of this question correct.

Question 3

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in Math 327 (a course prerequisite), as well as in ECE 331 (the current course). The question itself dealt with using the inductive proof technique in order to verify the closed form of a particular arithmetic series. I expected 75% of the students would understand the proof mechanism, but less than 50% would correctly provide all of the proof details (in particular, all of the details in the extension step).

Question 4

This question was meant to address outcome A. The knowledge necessary to answer the question should have been gained in ECE 131, ECE 231 (a course prerequisite), as well as in ECE 331 (the current course). This problem asked students to analyze the running time of a very simple algorithm. I expected 90% of the students to correctly answer this question.

Question 5

This question was meant to address outcomes B and C. The knowledge necessary to answer the question should have been gained in ECE 131, ECE 231 (a course prerequisite), as well as in ECE 331 (the current course). This question asked the students to write an algorithm that computed a simple statistic associated with a data set. I expected that 75% of the students could perform this task successfully.

2. Results

Ten students took the knowledge probe, and every student answered every question. Thus, the allotted time appears to be sufficient for all students to answer the questions to the extent necessary to demonstrate their knowledge.

Question 1

Only three of the students answered the question correctly. Two others appeared to understand the concept of expectation, but did not arrive at the correct answer. Of the students not answering the question correctly, some seem puzzled by the fact that the answer might not be an integer. E.g., one student calculated the expectation, but then dismissed the answer (because it was less than 1), and incorrectly answered 0.

Question 2

Six of the student wrote down the correct answer. Five of the students wrote down the correct equation $\binom{5}{2}$, and four of these evaluated the equation as well. Of the six students that answered the first part correctly, all but one understood how to solve the second part.

Question 3

Eight of the students seemed to understand the mechanisms behind a proof by induction, but only four could actually work the proof.

Question 4

All ten students correctly analyzed the running time of the algorithm, but two of them noted they were unsure of the result.

Question 5

All ten students could write an algorithm that computed the statistic, and most of the solutions were very succinct as well.

3. Analysis

The mathematics preparation of the students did not match my expectations. In particular, knowledge of basic probability theory does not seem to be sufficient.

Knowledge of discrete mathematics was also somewhat weak, but nearly matched my expectations. The students' ability to use asymptotic analysis, however, appears to be the one bright spot in terms of mathematics preparation, exceeding expectations. Some of this may be due to the fact that this technique is used heavily in this class (ECE 331), so the students were very recently exposed to it. The ability of the students to analyze/interpret data (i.e., compute a statistic associated with some data) was very strong, and again exceeded expectations.

4. Suggested Actions and Follow-up

- Knowledge of basic probability theory should be probed more deeply in future KPs. In addition, the results of this KP should be discussed with those in the department responsible for ECE 340 to see if they might be able to provide some insights on the results.
- The discrete mathematics background was about what I expected. We need to continue to have a dialog with the Mathematics & Statistics Department about Math 327, and the needs of our students.