ECE 231 – Knowledge Probe – Spring 2011

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ABET Outcomes Probed: A, B, C, D, E

> **ABET Program Outcomes:** Engineering programs must demonstrate that their students attain the following outcomes:
>
> (a) an ability to apply knowledge of mathematics, science, and engineering
> (b) an ability to design and conduct experiments, as well as to analyze and interpret data
> (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
> (d) an ability to function on multidisciplinary teams
> (e) an ability to identify, formulate, and solve engineering problems
> (f) an understanding of professional and ethical responsibility
> (g) an ability to communicate effectively
> (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
> (i) a recognition of the need for, and an ability to engage in life-long learning
> (j) a knowledge of contemporary issues
> (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
>
> Program outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program. Program outcomes must foster attainment of program educational objectives.
>
> There must be an assessment and evaluation process that periodically documents and demonstrates the degree to which the program outcomes are attained.

Relevant pre- and co-requisite classes: ECE 131 or similar introductory programming course.

Catalog Description:
Introduction to elementary data structures, program design and computer-based solution of engineering problems. Topics include use of pointers, stacks, queues, linked lists, trees, graphs, systems and device-level programming and software design methodology.

Instrument
The knowledge probe (KP) consisted of six questions given to students in the class in Exam1. With the test, the code for some of the problems were emailed before the test,

and each student had the chance to compile, test and debug the code to answer the exam questions. A hands-on type of exam.

In addition, oral exams were given to students and questions were asked in reference to the programming projects assigned. A total of ten assignments were given in the semester. Even though, students were encouraged to work in teams, the oral exams were mostly done on a one-on-one basis.

Exam2 was not given due to the wide gap between students who had and learned problem solving skills and translating it into C/C++ code and thus who did not have the necessary background, which were asked to re-take the class.

Exam1 Questions

- Question 1: ABET outcome(s) probed E
  - 85% of class got it correct
- Question 2: ABET outcome(s) probed E
  - 90% of class got it correct
- Question 3: ABET outcome(s) probed A, E
  - 85% of class got it correct
- Question 4: ABET outcome(s) probed A, E
  - 90% of class got it correct
- Question 5: ABET outcome(s) probed B, E
  - 80% got it correct
- Question 6: ABET outcome(s) probed B, E
  - 80% of class got it correct
- Question 7: ABET outcome(s) probed B, E
  - 85% of class got it correct
- Question 8: ABET outcome(s) probed A, B, E
  - 75% of class got it correct

Assignments

I encouraged students to work in teams so they can learn from each other. There was a wide gap between students with a programming background and those who did not retain hardly anything from ECE 131 or equivalent course. During lab/recitation sessions the different groups would present how they were approaching the problem and potential solutions. From the assignments given concepts such as complex number operations, convolution, statistics (min, max, average, standard deviation, variance, histogram), matrices, multi-value functions, sorting, were presented.

- Assignment 1: ABET outcome(s) probed A, B, C, D, E
- Assignment 2: ABET outcome(s) probed
- Assignment 3: ABET outcome(s) probed A, B, C, D, E
- Assignment 4: ABET outcome(s) probed A, B, C, D, E
- Assignment 5: ABET outcome(s) probed
- Assignment 6: ABET outcome(s) probed A, B, C, D, E
- Assignment 7: ABET outcome(s) probed A, B, C, D, E
- Assignment 8: ABET outcome(s) probed A, B, C, D, E
- Assignment 9: ABET outcome(s) probed A, B, C, D, E
- Assignment 10: ABET outcome(s) probed

Suggested Actions and Follow-up

- At least 3 to 4 classes should review material presented in ECE 131.
- Knowledge of binary, octal, and decimal number systems should be probed more deeply in future KPs.
- Knowledge of numbers (Natural, Integers, Fractional, Irrational, Real and Complex) should be probed more deeply in the future.
- Closer and better coordination needs to be developed between ECE131 and ECE 231. Coordination in the material presented in lectures and assignments given.
- Recitation/lab sessions are needed for students to learn. Teamwork and student tutoring helps greatly. Besides discussing on how to do the assignment, concepts on number systems, statistics, matrices and convolution are presented. This greatly helps students understand not only the programming tricks but engineering concepts that they will see in future classes have already been introduced.
- Problem solving skills need to be addressed in ECE131 and other introductory engineering courses. Students have a hard time first coming up with a strategy for solving a problem and then translating it into a programming language.
- Coding style needs to be enforced.