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Knowledge Probe

ECE 419

November 2, 2009

Student 1 High

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ECE419 Survey

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Give an encompassing answer to the following questions. Use as much space if you need.

1. While trying to solve an engineering problem, evaluate a process, or gather a new set of experimental data, give a brief description of steps that are required to achieve these goals. (i.e. describe steps in experiment design and data collection)

When encountering a new problem, one must ask themselves what is the question focusing on and what resources need to be used to address the problem. Some problems are simple and require only the knowledge that one contains, while many others are strenuous and require large amounts of resources to address the problem. The focus of the question will guide us to the area of concentration of which the problem comes from; i.e. logic design, power design, electro-magnetism, antenna theory, software design, mechanical design etc. With this focused establish an individual or group can then look into the area of research to begin to pull material that one feels is relevant to the problem at hand. Usually this starts out with basic web gathering then goes deeper into journals, papers, research studies etc.

Once information has been gathered, limitations can then begin to be placed in relation to the problem at hand. Usually a similar process, if one exists is closely examined and tested to understand how this process is created and works which can then be implemented to the problem at hand. Usually for a process evaluation for an engineering problem includes a problem description. A basic flow chart of a way to develop a solution to the problem. A flow chart describing a way to a solution to the problem, along with listing of limitations and test data and results confirming expectations along the way that are to be met. A process should be able to be followed by any one that knows nothing about the problem and be capable of understanding how and why one went about solving the problem.

One important aspect of problem solving is the ability to gather experimental data. Now for each application this could be different. Some will be running software against test cases in a scripting file, while others in research related problems will pick boundary conditions that when evaluated in the math model gave a desired behavior or lack of behavior and tested for. These boundary conditions are where the true accuracy of ones work comes into question and how well it addresses the problem. Some data sets can be analytically derived while some will be tested against data sets that describe a fairly close system to the problem. Most test data is created around the

limitation conditions of the customer, technology, or desires or problem. A data set that includes large sets that vary in the range of possible inputs can be good and be tested thoroughly to insure the problem is solved using a design that works more than once and is dependable.

2. From your previous classes' experience, describe advantages and disadvantages of teamwork

For most of the classes that have included team work for projects there have been both advantages and disadvantages. Some advantages are that the work load can be usually equally distributed throughout the group members with each taking responsibility for their parts. This allows each person to give their own input into the project. However, this can also be a disadvantage due to the fact that sometimes the individuals have no clue on how to do certain parts of their project and provide results or solutions that never work or even feasible, along with the chance that those parts are just not even completed or looked at. Another common occurrence within group projects is that large amounts of the project is left for later dates due to the fact that group members all have different schedules and have more items to do on a weekly basis that prevents the project from moving forward at a good pace. This can lead to stress within the group and cause great amount of friction between members and lead to an incomplete project if the group can't get past this. In addition to the stress, it also causes group members to be at completely different paces within the project. Some people may have way more time than others thus allowing them to exceed expectations while others have almost no time and contribute very little besides meeting times. For the senior design project, it feels like project presentations should almost be done during the summer just so that seniors get more time to coordinate for both spring and fails terms of the project instead of just spring and really only have of the fall term. This half fall term of true work on the project seems to really fall flat due to actual decisions of what projects to take are decided around midterms and beginning research and project definition occur around time of term projects and other smaller group projects that all other classes require. It appears to be fine for those taking 4 or less classes but for those with 16 to 18 credit hours have to juggle around the work load for this half fall term semester for just the planning and beginning phases of the project. Another problem with team projects is that some members don't have enough experience when compared to the other team individuals, and school and previous classes don't prepare you for this. Really need work or previous history to be able to be prepared for some of these design projects, that of which the department will never be able to provide with the way it currently has it curriculum structured. This causes the groups to catch each other up on stuff that the problem requires individuals need to know before work can be complete. Team work works great when every one has worked with each other before and understands each others weaknesses and strengths, newly formed groups have adjustments times.

3. Describe typical roles and responsibilities in a multi-disciplinary team. What professional fields are typically represented?

Typical roles in a multi-disciplinary team usually include a team leader, information expert, technical expert. The team leader is in charge of making sure tasks are constantly being worked on and making sure tasks are completed in a timely manner with accuracy. Team leader is also in charge of providing task definitions for team members and setting up meetings where issues can be discussed and resolved. Information expert is an individual who is charge of collecting and organizing all the documents that are written and used for the project. All these documents are to be updated when changes are needed to be made and be easily access-able to other group members if information is needed for a particular issue or task. The information expert could also be skilled in the mathematical models that describe the problem and provide guidance to other group members lacking or in need of this background. The technical expert is someone who can work well with the environment they are placed in and can take all the group materials and actually construct the implementations of the solutions of the problem that of which can then be tested. This can range from soldering, coding mathematical algorithms, understanding and maintaining the working software environments that the group uses, implementing tests of the data sets and providing the results to other group members. There can be many more roles than this and these roles can also be sub-divided even more into specialties depending upon the program size and difficulty.

For engineering problems, I have constantly seen more than just engineers working on solutions to a problem. Usually I see a mechanical engineer take care of all the dynamics and statics of the system if needed, physics specialist that takes care of any thing that usually is deeply rooted in complex theory of physics. These individuals will make sure that the problem is do able along with the mathematics specialist. Electrical engineer takes care of all the electronics and signal/power design for the systems. Computer engineer/computer science specialist that is in charge of interfacing any software with the hardware along with testing of the digital systems and maintaining the digital architecture systems.

These are the groups of people that I constantly see pooled together to work on large projects. If these specific class of individuals are not present people with the greatest background will be in charge of these areas based upon assignment.

4. Based on the all previous classes you have taken at UNM, describe what you learned about the engineering tools are currently available to engineers? (this includes software, hardware, etc)

From all the previous classes I have taken at UNM, the tools I have learned about is quite limited in range and use. Java and C++ are the main programming tools I have used throughout my time at UNM, Matlab in my late junior/senior year and very little exposure to its full potential. In the labs, get exposure to voltmeters and some basic tools for circuit/electronic analysis but once the class is completed usually don't see software or hardware associated with the class any more. Hardware is pretty limited to class only and the connection of hardware with other classes is very rare, the dots are usually not even connected. Example is how to use a signal processing chip for dsp related items after taking signals class. Never get any exposure to this or to Matlab and its signal tool box that is available to us. Biggest thing is that usually we will never

experience most of these tools if the instructor does not call for it due to class limitations, time, or resources for the hardware and software. I've come to accept the fact that in order to truly learn about the tools available one has to learn about them outside of class. Just appears that school is too narrow minded on exposure to all the tools out there in my opinion.

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    - When tackling any type of Engineering problem it is first important to fully understand the scope of the problem or goal. An accurate understanding of the task to be completed helps to determine the best ways to begin solving it. It is also beneficial to research the history of the problem to see how or if others have attempted to solve it.

    - Develop a hypothesis or plan to begin solving the problem.

    - The next step is to identify the resources available to begin solving the problem. From the available tools and resources at you disposal you can begin to isolate the particulars that will help you to get your desired result.

    - The next step would be the experiment, data capture, and/or analysis to test your hypothesis.

    - The final step would be characterization and validation of your results.

    - This will determine how successful the approach was in solving the problem.

2. **From your previous classes' experience, describe advantages and disadvantages of teamwork**

   In my previous classes teamwork has proven to have advantages and disadvantages. The main advantage of a team is that you are able to discuss ideas, concepts, and or theories openly and receive various opinions and points of view. This often opens the door to newer easier ways of solving problems. In many cases this makes potentially large problems much easier to tackle. Also having a team also gives you solid resources to check your work against to ensure the best overall results. The main disadvantage of team work is dividing up the overall work. Often times a team member may not pull their weight or their method of solving the problem conflicts with the rest of the methods of the other team members. A prime example of this is software coding. Coding styles can vary greatly from person to person making the task of pulling multiple segments together very difficult. Also if a member of the team fails to produce their portion of the work it adds additional stress to the team overall.

3. **Describe <u>typical</u> roles and responsibilities in a multi-disciplinary team. What professional fields are typically represented?**

   Typical roles in a team are dependent on the focus of the group and the disciplines of the individuals involved. In my experience with ECE there is generally a project leader, a spokesman, and individuals in charge of key project areas such as hardware design, software design, mathematical theory, fabrication and characterization. The professional fields represented can include math, science, EE and CE.

4. **Based on the all previous classes you have taken at UNM, describe what you learned about the engineering tools are currently available to engineers? (this includes software, hardware, etc)**

   The main tools I have learned to utilize are computational software programs such as MATLAB and design software tools such as Lab View. There are many different types of software available but the main goal of these programs is to provide an easy means to design a solution to a given problem and be able to verify through computation that the design is feasible for solving that problem. On the hardware side there are components such as FPGA's, Microprocessors, and other various electronic instruments used to measure performance and behavior of designs. I have learned, using these tools, how to design a hypothesis to solve a problem, whether it is a circuit, program, filter, antenna, ect. and verify its performance numerically to ensure it is a valid solution to a problem.

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   I guess you would need to know and do the following.
   1. **Know and understand the system that you are working.**
   2. **Be able to measure the output of the system while inputting a known input.**
   3. **Understand basic circuits and electronics design.**

2. From your previous classes' experience, describe advantages and disadvantages of teamwork

   With teamwork the group is able to accomplish a goal quicker and also help each other understand the problems. However, teamwork can cause some individuals to not contribute to the rest of the team.

3. Describe typical roles and responsibilities in a multi-disciplinary team. What professional fields are typically represented?

   Leaders and followers? I don't know.

4. Based on the all previous classes you have taken at UNM, describe what you learned about the engineering tools are currently available to engineers? (this includes software, hardware, etc)

   1. Used Matlab to solve control problems.
   2. Used Multisim to simulate circuits.
   3. Programmed Xilinx microprocessors.