Name:_____ Student #:_____

University of Toronto
Faculty of Applied Science and Engineering
APS112 and APS113 Engineering Strategies and Practice II

Quiz #2 April 8, 2014

This is a 50-minute closed-book quiz. No aids are permitted except for a translation-only dictionary. The quiz has a total of 18 questions. There are 12 multiple-choice questions and 6 written-answer questions. There are a total of 30 marks with 12 marks for the multiple-choice questions and 18 marks for the written questions.

Your question papers, with your name and student number filled in on the front page and the written-answer pages, must be returned with the multiple-choice answer sheet slipped inside. Do not separate any pages.

Multiple Choice Questions (1 mark each; total of 12 marks)

For multiple choice questions, you must use the multiple choice answer sheet provided – fill in your name and student number. Follow the directions on the sheet carefully to ensure that you receive marks for the correct answer. **You should mark only the single, most correct answer for each question.** Always mark the answer in the spot corresponding to the question number. Use a pencil. Erase any errors completely. There is no deduction for wrong answers.

Good Luck!

Written Answer Mark Breakdown

Question	Possible Marks	Marks
13	3	
14	4	
15	4	
16	4	
17	2	
18	1	
Total	18	

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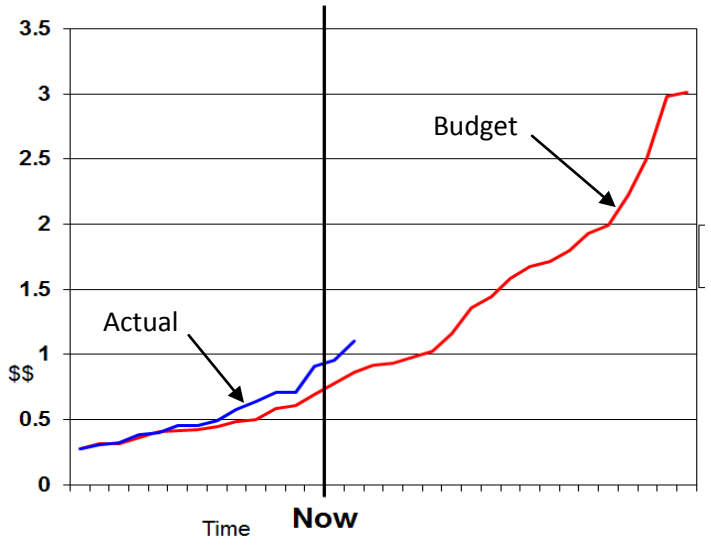
1. For a finished, marketed design of a hairdryer in Canada, what would be LEAST affected by the method of connection of the two halves of the hairdryer shell:
    a. Aesthetics (how it looks)
    b. Safety
    c. Ease of Assembly
    d. Ease of Repair
    e. Cost of Parts

2. For a simplistic design, there are two possible failure modes:
    i. that has a probability of happening of .1 and a cost if it happens of 10, and
    ii. that has a probability of happening of .2 and a cost if it happens of 8

    So the risk involved with this design is

    a. .02
    b. .3
    c. 1.3
    d. 2.6
    e. 18

Questions 3 through 5 refer to the chart of **Cost versus Time** show below:



The longer line on the chart is the budgeted costs as the project goes through the proposed schedule of tasks; the shorter line tracks the costs that have been incurred as the tasks have actually been completed. NOW shows the place that the proposed schedule indicates the project should be.

3. The Budgeted Cost of Work Performed would be closest to:
    a. 3.0
    b. 1.1
    c. .95
    d. .8
    e. .7

4. The Cost Performance Index would be closest to:
    a. .8/1.1
    b. 1.1/.8
    c. .95/.7
    d. .7/.95
    e. .7-.95

5. A reasonable estimate, based on current performance plus assuming that the rest of the schedule is correct, is that the project will finish:
    a. On time, on budget
    b. Early, with a cost overrun of .3
    c. Early, with costs being under the projection by .3
    d. Late, with a cost overrun of .3
    e. Late, with costs being under the projection by .3

6. The Utility Patent covering improvements on the Frisbee flying disc claimed:
    a. The ornamental design of a more marketable version of the Frisbee.
    b. A flying disc with a set of ridges to modify the airflow on the convex side.
    c. The dimensions and specific grade of polymer needed to manufacture the disc.
    d. The trademarked name "Wham-O Frisbee."
    e. None of the above answers is correct.

7. The Design of the Icon A5 light sport aircraft involved a detailed analysis of the potential customers for the plane. The core of the method was:
    a. An extensive survey of existing pilots to see what features they would want in a new plane.
    b. A series of focus groups each involving a different demographic.
    c. An internal discussion with employees of the company voting for the features that they thought would be most desirable.
    d. Estimating/guessing the opinion of five fictitious customers from five different potential markets.
    e. All of the above are false: The configuration of the plane was governed entirely by engineering performance considerations, since the performance of the plane was considered to be the most important selling feature.

8. John Quinlan has an issued (granted) U.S. Utility Patent, which he applied for on June 3, 1999. The patent covers a special dual handled cooking knife, but you have just found a French patent from 1975 with the exact same configuration as Quinlan's invention.

    Which of the following four statements is most correct as of today's date (2014):
    a. Quinlan should call his lawyers. He might be infringing on the 1975 patent and could have to pay damages.
    b. Quinlan's patent will protect his intellectual property and cannot be challenged, since it was granted by the U.S. patent office.

c. Quinlan has protection for the ornamental design of the knife only.
d. The French Patent serves as prior art that could be used to strike down Quinlan's patent in a court challenge.

9. In one sense, the Pugh Selection Matrix is better than the Weighted Decision Matrix for choosing the best design alternative because:
   a. It provides a numerical score proportional to performance.
   b. It allows for a simple pairwise comparison between alternatives.
   c. It can be done in one pass and is therefore quicker.
   d. None of the above.

10. The "*bathtub curve*" refers to a widely observed trend in reliability engineering. It describes:
   a. The relative failure rate of components during the first part, middle part and end part of their lifetime.
   b. The quality resulting from low, medium and high levels of expense and effort.
   c. The rate of return on an investment in a Quality Engineering program.
   d. The relationship between the number of failures and the number of customer returns.
   e. The slope of the bottom of a bathtub needed to effectively drain the water.

11. Codes and Standards govern many aspects of engineering where failure might have an adverse effect on the public. Which of these statements (a, b c, or d) is FALSE:
   a. Codes may specify materials to be used for a specific part.
   b. Codes are often based on experience with past failures.
   c. Codes can make it difficult to introduce new engineering solutions for existing problems.
   d. None of the statements above are false. [Choose (d) if a, b, and c are all true.]

12. An electric cutoff saw is manufactured for home use. Which of the following statements is FALSE:
   a. A blade guard should rotate into place when the saw is in the up position.
   b. A two-button sequence should be used to prevent children from operating the saw accidentally.
   c. A warning label should be placed near the blade to indicate the possibility of cutting your fingers off.
   d. The User Manual should instruct users to wear eye protection when using the saw.
   e. None of the statements above are false. [Choose (e) if a, b, c and d are all true.]

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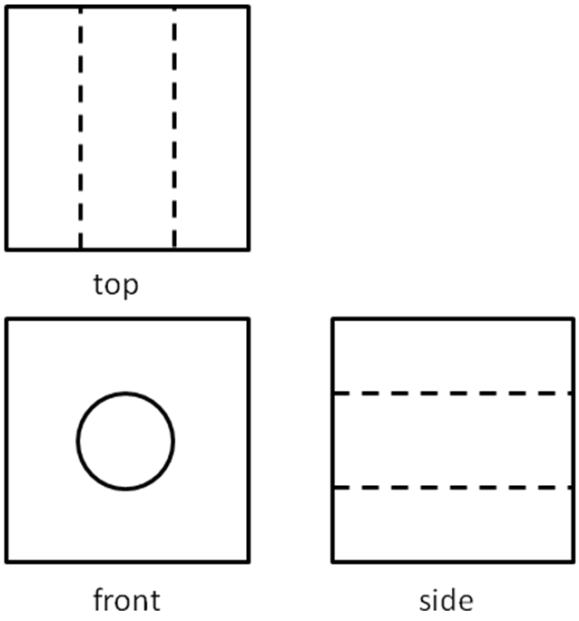
Written Answer (marks per question as indicated on question; 18 marks total)

13. (3 marks) The diagram below is called a _____ diagram.

Sketch a two-point perspective drawing of the block depicted below. Assume that it measures 5 cm x 5 cm x 5 cm and that it is sitting on the desk in front of you with three faces (top, front, and side) visible. Assume further that in the sketch, none of the faces is in the plane of the paper. Show construction lines if you use them.



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The remaining questions (14 - 18) deal with the following problem statement:

You are asked to design an ice and snow scraper for cleaning a car windshield. It will have adjustable length, a snowbrush and windshield squeegee at one end, and a scraper at the other end. The existing product from a competitor is shown in the figure below and has all of these features. It is made from aluminum tubing, plastic molded parts, rubber, foam and nylon bristles. Your company would like to sell the new version at a hefty profit so your boss asks you to rethink the whole thing to minimize manufacturing costs and to maximize profitability.

14. (4 marks) Describe (briefly) two general principles of design for manufacturing and assembly, and indicate how you would use these principles to minimize manufacturing and assembly costs for the new, redesigned product.

15. (4 marks) The existing product has a stamp that says "US Patents 8,503,509 and **D**765098" What do these numbers signify and what do they mean for your design process.

16. (4 marks) The main tube on the existing product is made from aluminum, and your boss suggests using some type of injection-molded plastic to save money. Given a) the plastic part would be injection molded, and b) the heavy loads put on the device when scraping ice from the windshield, what **challenges** might you face and **how would you address them**.

17. (2 marks) Even if the product works for the first year, long-term failure might be an issue. List two possible long-term failure modes for this product. Write one sentence for each one giving the name of the failure mode and how it might apply in this case.

18. (1 mark) How could you apply the principles of industrial design to improve sales? Give an example of a specific design feature that you would use for this product.