

Name: _____

ID #: _____

University of Saskatchewan
Department of Mechanical Engineering
ME 251 Engineering Analysis I

Midterm Exam

Thursday February 14, 2008

7:00pm-9:00pm

Instructor: Prof. FangXiang Wu

PLEASE READ CAREFULLY:

100 Points in Total

This exam has 8 pages. The last two pages are the standard normal distribution table and the t-distribution table. The exam is closed book. You are permitted to use your own calculator, but you are **not permitted** to store any course-related information in your calculator and to use it. However, you may use one page of a formula sheet made by yourself. There are 5 problems on the exam. Attempt all 5 problems. Please ensure that your answers are clear and legible. For all numerical results, please show at least four decimal places if they have.

Question	Total Marks	Score
1	20	
2	20	
3	20	
4	20	
5	20	
TOTAL	100	

I declare that I am the person named, and that I am formally registered as a student in ME 251.

Signature

Date

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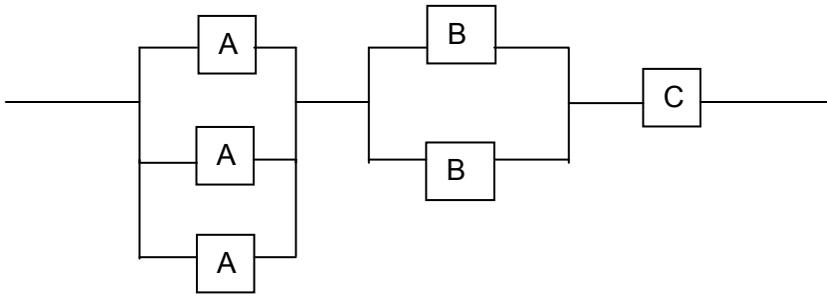
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1. (20 points) The probability of winning a food prize when you buy a coffee during a contest at a certain Canadian coffee shop is $\frac{1}{9}$. In order to conduct a statistical experiment, 80 students each buy one coffee a day for the next 10 days.
 - a) What is the probability that an individual student will win at least one food prize during the next 10 days?
 - b) What is the probability that between 50 and 60 of the 80 students will win at least one food prize during the next 10 days?

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2. (20 points) A mechanical system consists of three components A, B, and C connected in series. The reliability of components A, B and C is 85%, 90% and 95%, respectively. To improve the reliability of the system, three components A and two components B are respectively connected in parallel as shown in the figure below.



Assume that all components function independently.

- What is the overall reliability of this system?
- You are asked to increase the overall reliability of the system to 99% only using more components C. Is this possible? If yes, how many components C are needed? If not, why?

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3. Three textbooks were used this year in a large multi-section statistics class. 500 students used a textbook written by Prof. Mean, 300 students used a textbook written by Prof. Median, and 200 students used a textbook written by Prof. Mode. In a survey at the end of the year, 200 of the students who used Prof. Mean's textbook were satisfied with their text. 150 of the students who used Prof. Median's textbook were satisfied with their text, and 160 of the students who used Prof. Mode's textbook were satisfied with their text.

A student who took this statistics class is selected at random. If the student says that he was satisfied with his textbook, is the student most likely to have used the text by Prof. Mean, Prof. Median, or Prof. Mode? Who is the least likely author of this particular student's textbook?

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4. (20 points) The widths of a sample of ten of certain silicone chips are measured (in cm) as follows:

3.21 2.99 2.94 4.08 4.02 3.82 3.30 3.25 3.34 3.91

Assume that the widths of the certain silicone chips are normal distributed.

- a) Find a 95% confidence interval for the mean of the chip width.
- b) If an engineer wants to test $H_0: \mu=3$ versus $H_1: \mu \neq 3$ at a 5% significant level, what conclusion can she draw based on the result from a)

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5. (20 points) A study is conducted to estimate the difference between the dissolve time of semi-sweet chocolate and that of milk chocolate. Eight people each dissolved one piece of semi-sweet chocolate, while seven other people each dissolved one piece of milk chocolate. The dissolve times (in second) are as follow:

Semi-sweet: 30 55 50 22 46 45 30 44

Milk: 45 58 23 64 105 93 28

Assume that two populations are normal distributed and independent.

Find a 90% confidence interval for the difference between the mean dissolve time of milk chocolate and that of semi-sweet chocolate in two cases:

- a) Assume that the populations have the same variance.
- b) No information about the variances is available. We must assume that the population variances are unequal.