

Department of Electrical and Computer Engineering

ENGR 371 Probability and Statistics in Engineering

Midterm Exam – February 13, 2013

3.68
46

You can only use the faculty approved calculator with sticker.

Pens, pencils, erasers, and straight edges only. No crib sheets. NO CELL PHONES.

If you have a difficulty you may try making REASONABLE assumptions. State the assumption and how that assumption limits your answer. Justify your responses.

- Venn Diagrams. (This is a hint) Screws are inspected for three kinds of defects: the absence of a slot (type 1 defect), defective thread (type 2 defect), and improper thread length (type 3 defect). 250 screws are inspected with the following results: 110 have a type 1 defect; 168 have a type 2 defect; 103 have a type 3 defect. Of these, 53 have both a type 1 and a type 2 defect; 59 have both type 2 and type 3 defect; 54 have both type 1 and type 3 defect. Finally, 42 have all 3 defects. Prove that there has been a miscount.

(4 marks)

- Three stores labeled A, B and C have respectively 8, 12, and 14 employees, of whom 4, 7 and 10 are under the age of 20.

- If we first randomly select a store, and then randomly select an employee from that store, what is the probability that the employee selected is under age 20? (3 marks)
- If the person selected was under age 20, what is the probability that the store selected was store B? (3 marks)

- Let X be a random variable with the following probability distribution

X	0	1	2	3	4
f(x)	1/16	1/4	3/8	1/4	A

- Find and plot the cumulative distribution function (CDF), F(x). (3 marks)

- Evaluate the mean and the variance of the random variable X. (2marks)

- Find $P(X=2)$ using the CDF in (a) (2 marks)

- If another random variable $Y=X^2+1$ is formed, find the mean $E[Y]$. (3 marks)

- You are determining which model of power cell to purchase for your project. Your project requires 6 power cells, at least 4 of which must work for the project to work. You would like your project to work for at least 100 hours. The two power cell characteristics are shown in the table below.

Characteristics of Power cells A and B for Question 4

	Model A	Model B
Probability of lasting over 100 hours	0.80	0.95
Cost per Unit	1\$	4\$

- If you were to purchase 6 Model A power cells, what is the probability that 4 or more cells will last over 100 hours? (3 Marks)
- If you were to purchase 6 Model B power cells, what is the probability that 4 or more cells will last over 100 hours? (3 Marks)
- From the above information, does the higher cost produce a *proportionally* higher performance (i.e. the cost is 4 times larger, is the improvement in probability 4 times larger)? Justify your answer. (2 Marks)
- Concisely explain in four or less sentences which power cell model you would choose and justify your answer with probability concepts. (2 Marks)

0.344

0.2544