**ECE 313 (Section G)**

**Homework 6**

**Due Date: Monday, Mar 13, 11:00 AM in the class**

Write your name and NetID on top of all the pages. Show your work to get partial credit.

**Problem 1 –** If the distribution function of *F* is given by



calculate the probability mass function of the random variable *B*.

**Problem 2 –** The probability density function of X, the lifetime of a certain type of electronic device (measured in hours), is given by



a) Find P{X > 30}.

b) What is the cumulative distribution function of X?

c) What is the probability that, of 7 such types of devices, at least 2 will function for at least 20 hours? What assumptions are you making?

 **Hint:** You’ve previously calculated the probability of device survival, and looked at N-out-of-M systems. Here you must bring those concepts together

**Problem 3 –** Let *X* be a random variable with probability density function:

$$f\left(x\right)=\left\{\begin{matrix}kx^{2}\left(1-x^{3}\right),&0<x<1\\0,&otherwise\end{matrix}\right.$$

1. Find the value of the constant *k*.
2. What is the cumulative distribution function of *X*?
3. Find *P{0.25 < X < 0.5}* by using the probability density function.
4. Find the probability in part (c) by using the cumulative distribution function *FX(x)*.

**Problem 4 –** Lifetimes of VLSI chips manufactured by a semiconductor manufacturer are approximately normally distributed with μ = 5x106 h and σ = 5x105 h. A computer manufacturer requires that at least 95% of a batch should have a lifetime greater than 4x106h. Will the deal be made?

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**Problem 5 -**

The time (in hours) required to repair a module of a rocket at ACME spacecraft company is an exponentially distributed random variable with parameter λ = 0.5 hr -1

Before the launch, the technical team found out that the solid-fuel booster module has been damaged and needs to be repaired.

1. What is the probability that the repair time exceeds 2 hours
2. What is the conditional probability that a repair time takes at least 10 hours, given that the technical team has already been repairing for 8 hours.

**Problem 6 -**

A system consists of blocks A, B, C, D and E connected as shown in the figure. The reliability of each block is exponentially distributed with parameter λ. Find the reliability of the system.

