Department of EECS - University of California at Berkeley
EECS 126 - Probability and Random Processes - Spring 2007
Midterm 1: 2/19/2007

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1. (10%)
You are given a 1-meter long wood stick. You choose two points A and B uniformly and independently on the stick. You cut the stick at A and at B. You are left with three pieces. What is the probability that you can form a triangle with the three pieces?

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2. (10%)
Let X be Poisson with parameter $\lambda > 0$. For any positive integer k, calculate

$$E(X(X-1)(X-2)\times\cdots\times(X-k)).$$

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3. (10%)
Two friends agree to go to a given bar between noon and 1:00 pm and to wait for ten minutes there. Assume they choose the time they go to the bar independently and uniformly between noon and 1:00 pm, what is the probability that they meet in the bar?

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4. (10%)
You do not feel too well and you wonder why. The prior probability that you have the flu, some food poisoning, or some other disease D is 10%, 5%, and 15%, respectively. The probability that you feel this sick if you have the flu, food poisoning. or the disease D, is 80%, 95%, 20%, respectively. What is the probability that you are sick because of food poisoning?

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5. (10%)
Can you find a probability space and events A, B so that

$$P[A|B] > P(A) \text{ and } P[B|A] < P(B)?$$

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6. (10%)
How many times, on average, do you have to roll a balanced die until you see all six faces at least once?

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7. (10%)
Let X be a random variable that is uniform in [0, 1]. Calculate the variance of X n for $n \geq 1$.

8. (10%)
State and prove Markov's inequality.

9. (10%)
You throw a dart randomly and uniformly in aunit circle. Let X be the distance between the dart and the center. Calculate E(sin(X)).

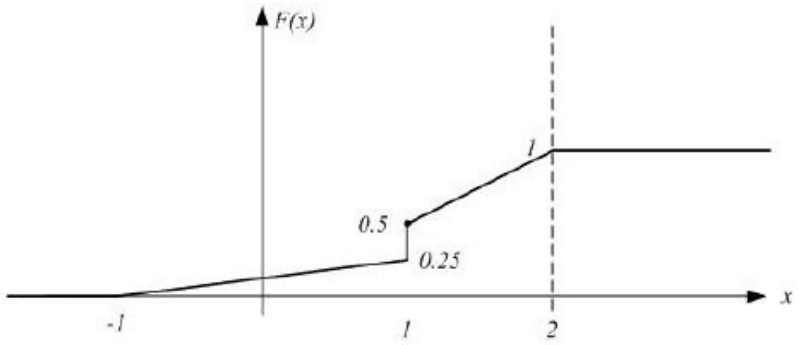

Figure 3: The cpdf of X.

10. (10%)
The random variable X has the c.p.d.f. shown above. Calculate E(X) and var(X).