King Saud University 1st semester 1436/1437 H

Computer Engineering Department CEN343: Introduction to Random Processes

College of Computer and Information Sciences

**HW # 1**

Name: ID#

**Question 1**

 A. Let us consider the experiment of tossing a die. Find the probabilities of the following events:

1. Event $A$ ={odd number shows up}.
2. Event $B$ ={number larger than 3 shows up}
3. $A∩B$
4. $A∪B$

B. In three boxes there are capacitors as shown in Table below. An experiment consist first of randomly selecting a box and then selecting a capacitor from the chosen box.

1. What is the probability of selecting 0.01 µF capacitor given that box 2 is selected.
2. What is the probability of selecting 0.01 µF capacitor.
3. If a 0.01 µF is selected what is the probability that it came from box 3.

|  |  |  |  |
| --- | --- | --- | --- |
| **Capacitor (µF)** | **Box1** | **Box2** | **Box3** |
| 0.01 | 20 | 95 | 25 |
| 0.1 | 55 | 35 | 75 |
| 1 | 70 | 80 | 145 |

**Question 2**

1. Find the mean and variance of a uniform density function defined in the interval $\left(a, b\right), $the probability density function is given as follows:

$$f\_{X}\left(x\right)=\left\{\begin{array}{c}\begin{matrix}\frac{1}{b-a}&a\leq x\leq b\\0&else\end{matrix}\\\end{array}\right.$$

1. Let us consider a random variable $X$ with the following probability density:

$$f\_{X}^{}\left(x\right)=\left\{\begin{matrix}ae^{-ax} x\geq 0\\0 x<0\end{matrix}\right.$$

Determine the $E\left[X\right]$ and $E\left[X^{2}\right]$ using the moment generating function$ϕ\_{X}(ω)$.

**Question 3**

Given the function

$$f\_{XY}\left(x,y\right)=\left\{\begin{matrix}b\left(x+y^{2}\right) -2<x<2 , -3<y<3 \\0 Otherwise\end{matrix}\right.$$

1. Find the constant $b$ such that $f\_{XY}\left(x,y\right)$ is a valid joint density
2. Determine the marginal density functions $f\_{X}\left(x\right)$ and $f\_{Y}\left(y\right)$
3. Determine the class conditional density $f\_{X}\left(x|-3<y<3\right).$
4. Are X and Y statically independent.