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Notre Dame University Faculty of Natural and Applied Sciences Department of Mathematics and Statistics

MAT 326

Probability & Statistics for Engineers Exam #1

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Duration: 55 minutes

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| Grade: |

Please note that you have 6 questions and 7 pages Round all your answers to 3 digits after the decimal point.

1) (12 points) From a group of 7 students of which two are math students, a committee of 3 randomly selected students is needed. Let X be a random variable representing the number of math students among the selected committee. Find the probability distribution function of X. What is P(X = 2)?

- 2) (16 points) Customers at a certain superstore pay their bills either by cash money with probability 0.8, or by their credit cards with probability 0.2.
 - a) For the 10 customers arriving at the superstore, find the probability that at least 8 of them pay by cash money.

$$P(CH) = 0.8 \quad P(CC) = 0.2$$

This is a Bunomial experiment with $m = 10$. $p = 0.8$

$$P(Y = 8) = P(Y = 8) + P(Y = 2) + D(Y = 10)$$

$$= \frac{10!}{8!2!} = \frac{0.8}{2} = \frac{0.8}{2!} = \frac{10!}{2!} = \frac{0.8}{2!} = \frac{10!}{2!} = \frac{0.8}{2!} =$$

b) Of the customers arriving at the superstore starting the opening time, find the probability that the 3rd customer pay by credit card is the 10th arrival.

-0.6年年年.

This is a mapstile Brown with
$$r = 3$$
 $m = 10$.

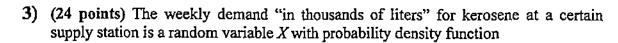
P(Y=10) = $\binom{3}{2} p^{3} (1-p)^{7}$

= $\frac{9!}{7!2!} 0.2^{3} 0.8^{7}$

= $\frac{9 \times 8}{2} \times 0.2^{3} \times 0.8^{7}$

= 0.06

:::



$$f(x) = \begin{cases} kx & \text{for} & 0 \le x \le 2\\ 2k & \text{for} & 2 < x \le 4\\ 0 & \text{elsewhere} \end{cases}$$

$$f(x) = \begin{cases} kx & \text{for} & 0 \le x \le 2 \\ 2k & \text{for} & 2 < x \le 4 \\ 0 & \text{elsewhere} \end{cases}$$
a) Find k.
$$\begin{cases} x \times 4 & \text{for} & \text{for}$$

b) Find the probability distribution function F(x)

$$F(x) = \begin{cases} x^{2}/12 & 0 \le x = 2 \\ \frac{1}{3} \ln x - \Lambda & 0 \le x \le 4 \\ \frac{1}{3} \ln x - \Lambda & 0 \le x \le 4 \end{cases}$$

$$0 \le x \le 2 \implies F(x) = \begin{cases} \int g(x) dx = \int F(x) dx. \end{cases}$$

$$=\frac{\sum_{i=1}^{n} x_{i}^{2}}{2} = \frac{x_{i}^{2}}{12}$$

$$\begin{cases}
S_{1} & \text{option } F(x) = \int_{0}^{\infty} (x) dx \\
&= \int_{0}^{\infty} F(x) dx + \int_{0}^{\infty} f(x) dx$$

$$= \int_{0}^{\infty} f(x) dx + \int_{0}^{\infty} f(x) dx + \int_{0}^{\infty} f(x) dx$$

c) The weekly profit "in dollars" is a random variable Y given by Y = 324X - 142. Find

i)
$$E(Y)$$

$$E(x) = \int_{-\infty}^{\infty} x \, g(x) \, dx + \int_{0}^{\infty} x \, g(x) \, dx$$

$$= [K \times \frac{3}{3}]_{0}^{3} + [K \times \frac{1}{3}]_{0}^{4}$$

$$= [K \times \frac{9}{3}]_{0}^{3} + [K \times \frac{1}{3}]_{0}^{4}$$

$$= \frac{8}{18} + \frac{19}{6}$$

$$= \frac{8}{18} + \frac{19}{6}$$

$$= \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$$

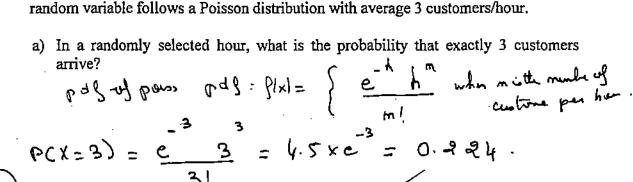
$$= \frac{8}{3} + \frac{1}{8} + 2$$

$$E(Y) = 324 E(x) - 142$$

$$E(Y) = 650 \text{ }$$
ii) $P(Y \le 749)$

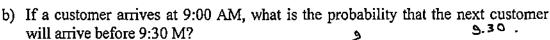
2 < x 5 h





4) (24 points) The number of customers arriving at a certain checkout counter is a

$$P(X=3) = \frac{e^{-3}}{3!} = \frac{3}{3!}$$



will arrive before 9:30 M?

$$k = 3 \text{ uslowe/hour} \Rightarrow \text{ uher e T is the surcarvie time between P(T < 30 monitor)}$$

c) If the opening time of the counter is 9:00 AM, what is the probability that the second customer will not arrive before 9:30 AM?

= e = e 6

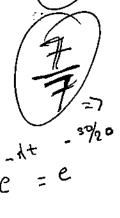
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beyond that perhod,

The queither it

about the 2nd cartoner among



5) (12 points) A factory uses two machines to produce one type of tires. It is known that 5% of the tires produced by the first machine are defective, and of those produced by the second machine, 8% are defective. On a certain day 40% of the supply was produced by the first machine, one tire was randomly selected from the supply and found defective. What is the probability that it was produced by the second machine?

Hodnix
$$\frac{A}{A}$$
 Hodnis $\frac{B}{B}$ $\frac{B}{B} = 0.08$.

 $P(A/A) = 0.05$ $P(A/B) = 0.08$.

 $P(A) = 0.4$ $P(B) = 0.6$.

 $P(B) = 0.6$.

 $P(A) = \frac{B(A/A)}{B(A)} =$

6) (12 points) the life lengths 'measured in hundreds of hours" of a certain type of fuses are independent and normally distributed with a mean of 1000 hours and a standard deviation of 196 hours. Two such fuses are randomly selected. What is the probability that only one of them will operate for at least 1100 hours?

$$P(X \ge 1100) = 0.305$$
.

The 2 are non-lung selected -> only one will operate for

It is a Binomial experiment