Department of Mathematics and Statistics KFUPM
STAT 319-02 Quiz#1, Time: 30 mins

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Q.No.1:- A manufacturer of automobiles conducted a market survey. Eighty percent of the customers want better fuel efficiency, while 55% want a vehicle navigation system and 45% percent want both features.

a. Find the probability that a person wants either better fuel efficiency or a vehicle navigation system.

b. Find the probability that a person wants better fuel efficiency but not a vehicle navigation system.

c. Find the probability that a person wants a vehicle navigation system given that he also wants a better fuel efficiency.

d. let the event A: the customers want better fuel efficiency, B: the customers want a vehicle navigation system, are the two events independent? Explain using probability.

Q.No.2:- In a semiconductor manufacturing process, three wafers from a lot are tested. Each wafer is classified as pass or fail. Assume that the probability that a wafer passes the test is 0.8 and that wafers are independent. Determine the probability mass function of the number of wafers from a lot that pass the test. Also find the probability of getting one wafers that passes the test.

STAT-319 Formula Sheet for First Major Exam Term 143

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = P(A \cap B') + P(A \cap B) + P(A' \cap B)$

$P(A \cup B) = 1 - P(A \cup B)' = 1 - P(A' \cap B')$ and $P(A \cap B)' = P(A' \cup B')$

$P(A \mid B) = \frac{P(A \cap B)}{P(B)}, P(B) \neq 0$ and $P(A \cap B) = P(A).P(B \mid A) = P(A \mid B).P(B)$

$P(B_i \mid A) = \frac{P(A \mid B_i).P(B_i)}{\sum_{i=1}^{k} P(A \mid B_i).P(B_i)}, P(A) \neq 0$

$\mu = E(X) = \sum x f(x)$; $E(X^2) = \sum x^2 f(x)$ and $\sigma^2 = E(X-\mu)^2 = E(X^2) - \mu^2$

Discrete Uniform Distribution: $f(x) = \frac{1}{n}$; $x = x_1, x_2, \ldots, x_n$; $\mu = \frac{x_n + x_1}{2}$; $\sigma^2 = \frac{(x_n - x_1 + 1)^2 - 1}{12}$

Binomial Distribution: $f(x) = \binom{n}{x} p^x (1-p)^{n-x}$; $x = 0,1, \ldots, n$; $\mu = np$; $\sigma^2 = np(1-p)$

Geometric Distribution: $f(x) = p(1-p)^{x-1}$; $x = 1,2, \ldots \ldots$; $\mu = 1/p$; $\sigma^2 = (1-p)/p^2$

Hypergeometric Distribution: $f(x) = \frac{\binom{K}{x}\binom{N-K}{n-x}}{\binom{N}{n}}$; $x = \max\{0, n+K-N\}$ to $\min\{K, n\}$; $\mu = np$;
$\sigma^2 = np(1-p)\frac{N-n}{N-1}$; $p = \frac{K}{N}$

Poisson Process: $f(x) = \frac{e^{-\lambda t}(\lambda t)^x}{x!}$; $x = 0,1, \ldots \ldots$; $\mu = \lambda t$; $\sigma^2 = \lambda t$

$F(b) = P(X \leq b) = \int_{-\infty}^{b} f(x)\,dx$ and $P(a < X < b) = \int_{a}^{b} f(x)\,dx = F(b) - F(a)$

$\mu = E(X) = \int_{-\infty}^{\infty} x f(x)\,dx$; $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)\,dx$ and $\sigma^2 = E(X-\mu)^2 = E(X^2) - \mu^2$

Continuous Uniform Distribution: $f(x) = \frac{1}{x_n - x_1}$; $x_1 \leq x \leq x_n$; $\mu = \frac{x_n + x_1}{2}$; $\sigma^2 = \frac{(x_n - x_1)^2}{12}$

Exponential Distribution: $f(x) = \lambda e^{-\lambda x}$; $x > 0$; $\mu = \frac{1}{\lambda}$; $\sigma^2 = \frac{1}{\lambda^2}$