Name # AHMAD ZAIB

ID # 13132

Subject # Probability

Department # BEE

Semester # 8TH

Teacher Name

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Date # 19-08-2020

Iqra National University, Peshawar
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IQRA NATIONAL UNIVERSITY

Mid – Term Examination Summer 2020
Date:19/08/2020

Course Code: _____ **Course Title:** Probability Methods in Engineering

Prerequisite: _____ **Instructor:** Engr. Pir Meher Ali Shah

Module: 3 **Program:** BEE **Total Marks:** 30 **Time Allowed:** _____

Note: Attempt all questions. PLO: program learning outcome C: Cognitive

Q1.	(a)	In a box there are 100 resisters having resistance and tolerance as shown in the Table below. Let a resistor be selected from the box and assume each resistor has the same likelihood of being chosen. Define three Events *A as "Draw a 47-ohm resistor", B as "Draw a resistor with 5% tolerance", C as "Draw a 100 – ohm Resistor", D as a Draw a 22-ohm Resistor and E as "Draw a resistor with 10% tolerance"*. Then Find the following Conditional Probabilities. ***P(A\B), P(A\C), P(B\C), P(D\E)***	Marks 6 CLO 1
	(b)	In a game of dice, a shooter can win outright if the sum of the two numbers showing up is between 7 and 11 when two dice are thrown. What is the probability of winning outright?	Marks 4 CLO 1
	(c)	A pair of fair dice are thrown in a gambling problem. Person A wins if the sum of numbers showing up is six or less and one of the dice shows three. Person B wins if the sum is five or more and one of the dice shows a four. Then find i. Probability that A wins ii. Probability that B wins	Marks 6 CLO 1

Resistance	*Tolerance* 5%	10%	*Total*
22	*10*	*14*	*24*
47	*28*	*16*	*44*
100	*24*	*8*	*32*
Total	*62*	*38*	*100*

		iii. Probability that Both A and B wins	
Q2	(a)	A student is known to arrive late for a class 30% of the time. If the class meets 4 times each week then find: i. Probability that the student is late for at maximum three classes in a given week ii. Probability that the student will not be late at all during a given week.	Marks 4 CLO 1
	(b)	Spacecraft are expected to land in a prescribed recovery zone 80% of the time. Over a period of time, six spacecraft landed. i. Find the probability that none lands in the prescribed zone. ii. Find the probability that at least one will land in the prescribed zone. iii. The landing program is called successful if the probability is 0.9 or more that three or more out of six spacecraft will land in the prescribed zone. Is the program successful?	Marks 6 CLO 1
	(c)	A single card is drawn from 52 card deck i. What is the probability that the card is a FACE CARD. ii. What is the probability that the card will be a 5 or smaller? iii. What is the probability that the card is 10?	Marks 4 CLO 1

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Q1a Ans. Solution:

	Tolerance.		
Resistance	5%	10%	Total.
22	10	14	24
47	28	16	44
100	24	8	32
total	62	38	100

Event:

A = Draw a 47Ω resistor.
B = Draw a 5% tolerance resistor
C = Draw a 100Ω resistor.
D = Draw a 22Ω resistor.
E = Draw a 10% tolerance resistor.

$P(A|B) = ?$, $P(A|C) = ?$

$P(B|C) = ?$ $P(D|E) = ?$

$$P(A) = P(47\Omega) = \frac{44}{100}$$

$$P(B) = P(5\%) = \frac{62}{100}$$

$$P(C) = P(100\Omega) = \frac{32}{100}$$

$$P(D) = P(22\Omega) = \frac{24}{100}$$

$$P(E) = P(10\%) = \frac{38}{100}$$

Now find the joint probabilities:

$$P(A \cap B) = P(47\Omega \cap 5\%) = \frac{28}{100}$$

$$P(B \cap C) = P(5\% \cap 100\Omega) = \frac{24}{100}$$

$$P(A \cap C) = P(47\Omega \cap 100\Omega) = 0$$

$$P(D \cap E) = P(22\Omega \cap 10\%) = \frac{14}{100}$$

Now find the conditional property:

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{28/100}{62/100}$$

$$= \frac{28}{62} = \left[\frac{14}{31}\right]$$

$$P(A|C) = \frac{P(A \cap C)}{P(C)} = \frac{0}{32/100} = [0]$$

$$P(B|C) = \frac{P(B \cap C)}{P(C)} = \frac{24}{100} / \frac{32}{100}$$

$$= \frac{24}{32} = \frac{12^3}{164} = \left[\frac{3}{4}\right]$$

$$P(D|E) = \frac{P(D \cap E)}{P(E)} = \frac{14}{100} / \frac{38}{100} = \frac{14}{38} = \left[\frac{7}{19}\right]$$

Q1 b Solution:

1,1	1,2	13	1,4	15	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

Each with $(P) = \frac{1}{36}$

Sum of {7 & 11} = (6,1), (5,2), (4,3), (3,4), (2,5), (1,6), (6,5), (5,6)

Therefore P(sum of 7 & 11) $= \frac{8}{36}$

$= \left[\frac{2}{9}\right]$ Ans

Q1 C Solution:

1,1	1,2	1,3	1,4	1,5	1,6
2,1	2,2	2,3	2,4	2,5	2,6
3,1	3,2	3,3	3,4	3,5	3,6
4,1	4,2	4,3	4,4	4,5	4,6
5,1	5,2	5,3	5,4	5,5	5,6
6,1	6,2	6,3	6,4	6,5	6,6

$P(S) = \frac{1}{36}$

$P(\text{sum of 6 or less}) = P(A) = \{(1,4),(2,4),(4,1),(4,2)\}$

$= \frac{4}{36} = \frac{1}{9}$

$P(A \text{ wins}) = \frac{1}{9}$

$P(\text{sum of 5 or more}) = P(B) = \{(1,4),(2,4),(3,4),(4,4),(5,4),(6,4),(4,6),(4,1),(4,2),(4,3),(4,5)\}$

$= \frac{11}{36}$

$P(B \text{ wins}) = \frac{11}{36}$.

$P(A \& B \text{ wins}) =$

$P(A \text{ wins}) = \frac{4}{36}$ because A L B

Q2(c)

Solution:

formula.

$$\binom{N}{K}(n)^K(1-p)^{N-K}$$

$$\binom{4}{}(0.3)^K(1-0.3)^{4-K}.$$

P(late 3 or maximum.

$$=\binom{4}{3}(0.3)^3(0.7)^1+\binom{4}{4}(0.3)^4(0.7)^0$$

$$=\left(\frac{4\times 3!}{3!}\right)(0.027)(0.7)+\left(\frac{4!}{4!}\right)(0.0081)(1)$$

$$4(0.027)(0.7)+(0.0081)$$

$$0.0756+0.0081$$

$$\{0.0837\}$$

$$P(\text{Not late at all})=\binom{4}{0}(0.3)^0(0.7)^4$$

$$=\{0.2401\}$$

Q2(b) Solution:

$N = 6$

$p = P(\text{Land in recovery zone}) = 0.8$

(a) $P(\text{None in zone}) = \binom{6}{0}(0.8)^0(1-0.8)^6$

$= (0.2)^6$

$= 0.000064$

$= (6.4 \times 10^{-5})$

(b) $P(\text{at least one in zone}) =$

$1 - P(\text{none in zone})$

$= 1 - 6.4 \times 10^{-5}$

$= 0.999936$

(c) $P(\text{success}) = P(3 \text{ in zone}) + P(4 \text{ in zone}) + P(5 \text{ in zone}) + P(6 \text{ in zone})$

$= \binom{6}{3}(0.8)^3(0.2)^3 + \binom{6}{4}(0.8)^4(0.2)^0 + \binom{6}{5}(0.8)^5(0.2)^1 + \binom{6}{6}(0.8)^6(0.2)^0$

$\left(\frac{6 \times 5 \times 4 \times 3!}{3!}\right)(0.512)(0.08) + \left(\frac{6 \times 5 \times 4!}{4!}\right)(0.4096)(0.04) + \left(\frac{6 \times 5!}{5!}\right)(0.32768)(0.2) + \left(\frac{6!}{6!}\right)(0.262144)(1)$

$= 0.983$. yes the program successfull.

Q2 (c) Solution:

$$P(A) = P(\text{Face card}) = \frac{12}{52} = \frac{3}{13}$$

$$P(B) = P(5 \text{ or smaller}) = \frac{16}{52} = \frac{4}{13}$$

$$P(C) = P(\text{card is } 10) = \frac{4}{52} = \frac{1}{13}$$

∴ Face card

Queen 4
King 4 — 12
Joker 4

∴ 5 or smaller.

2-4
3-4 — 16
4-4
5-4

10 card

= 4 → 2 Black + 2 Red.