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American University of Beirut
Math 204
Quiz II – (Fall 2015)

Time 70 minutes..

Name: **ID#:**

Circle your problem solving section number below:

✓ **Instructor: Ms Joumana Tannous**

Section 1 @ 1:00 M **Section 2 @ 11:00 M** **Section 3 @ 4:00 M**

✓ **Instructor: Mrs Maha Itani-Hatab**

Section 4 @ 11:00 Tu **Section 5 @ 8:00 Tu** **Section 6 @ 12:30 Tu**

✓ **Instructor: Ms. Michella Bou Eid**

Section 7 @ 12:30 Th **Section 8 @ 2:00 Th** **Section 9 @ 5:00 Th**

✓ **Instructor: Ms Najwa Fuleihan**

Section 10 @ 8:00 Tu **Section 11 @ 12:30 Tu** **Section 12 @ 11:00 Tu**

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1) In an Eng204 class there are 15 business students, 25 engineering students, and 10 computer science students. If a student is randomly selected by the instructor to answer a question, find the probability that the chosen student is:

a) an engineering major

(3 pts) $P(E) = \frac{25}{50} = \frac{1}{2}$ → total = 15 + 25 + 10 $\frac{{}_{25}C_1}{{}_{50}C_1}$

b) a business or computer science major

(3 pts) $\frac{{}_{15}C_1 + {}_{10}C_1}{{}_{50}C_1} = \frac{25}{50} = \frac{1}{2}$

2) Jad and Tanya are solving a physics problem. Jad has 75% chance of solving the problem while Tanya has 65% chance of solving the problem. Find the probability that:

a) only Jad solves the problem

(3 pts) $P(T') = 1 - P(T) = 1 - 0.65 = 0.35$ $P(J) = 0.75$ $P(T) = 0.65$

$P(J \cap T') = P(J) \times P(T') = 0.75 \times 0.35 = \frac{21}{80}$

- since they are independent events

b) neither Jad nor Tanya will solve the problem

(3 pts) $P(J' \cap T') = P(J') \times P(T') = (1 - P(J)) \times (1 - P(T)) = \frac{1}{4} \times 0.35 = \frac{7}{80}$

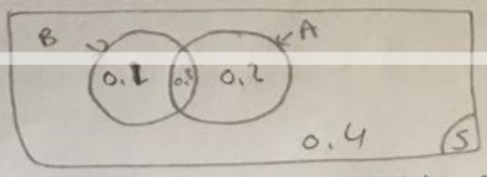
3) Given that $P(B) = 0.4$, $P(B/A) = 0.6$ and $P(A) = 0.5$.

a. Find $P(A \cap B)$. $= P(A) \times P(B/A)$

(3 pts) $= 0.5 \times 0.6 = \frac{3}{10}$

b. Draw a Venn diagram to represent the information

(3 pts)



c. Find $P(A/B')$. $= \frac{P(A \cap B')}{P(B')} = \frac{P(A) - P(A \cap B)}{1 - P(B)} = \frac{0.5 - 0.3}{1 - 0.4} = \frac{1}{3}$

(3 pts)

d. Find $P(A \cup B)$. $= P(A) + P(B) - P(A \cap B)$

$= 0.5 + 0.4 - 0.3 = 0.6$

(3 pts)

(3 pts) e. Find $P(A' \cap B') = P(A \cup B)' = 1 - P(A \cup B)$

$= 1 - 0.6 = \frac{2}{5}$

Double check

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4) Given a normal distribution with mean 10 and standard deviation 2, find

$P(7.64 \le X \le 12.7) = P(-1.18 < Z < 1.35)$

by symmetry $= P(-1.18 < Z < 0) + P(0 < Z < 1.35)$

$= P(0 < Z < 1.18) + P(0 < Z < 1.35)$

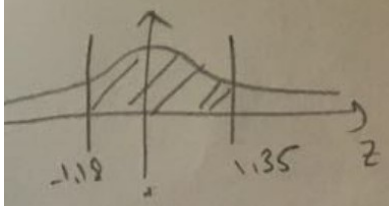
$= 0.3810 + 0.4115$

$= 0.7925$

$Z = \frac{X - \mu}{\sigma} = \frac{7.64 - 10}{2} = -1.18$

$Z = \frac{X - \mu}{\sigma} = \frac{12.7 - 10}{2} = 1.35$

(6 pts)



5) The probability that Rami gets up early is 0.8. If he gets up early, the probability of getting to work on time is 0.7. If he does not get up early, the probability of getting to work on time is 0.4.

a) Plot a tree diagram representing the information

(3 pts)

$P(T)$ = Probability of getting to work on time

$P(E)$ = getting up early

b) What is the probability that Rami

i. is getting to work on time and getting up early?

(2 pts)

$P(T \cap E) = 0.8 \times 0.7 = 0.56$

ii. is not getting to work on time?

(3 pts)

$P(\bar{T}) = P(E \cap \bar{T}) + P(\bar{E} \cap \bar{T})$

$= 0.8 \times 0.3 + 0.2 \times 0.6 = 0.36$

iii. is not getting to work on time or did not get up early?

(4 pts)

$P(\bar{T} \cup \bar{E}) = P(T \cap E)' = 1 - P(T \cap E)$

de Morgan's law

$= 1 - 0.56 = 0.44$

c) If Rami got to work on time, what is the probability that Rami got up early?

(4 pts)

$P(E/T) = \frac{P(E \cap T)}{P(T)} = \frac{0.56}{1 - P(\bar{T})} = \frac{0.56}{1 - 0.36} = 0.875$

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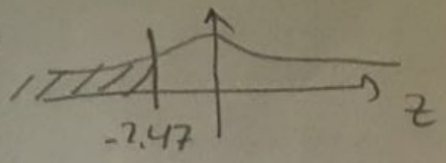
6) If z is the standard normal variable, find $P(z < -2.47)$

(4 pts)



$= 0.5 - P(-2.47 < z < 0)$

$= 0.5 - P(0 < z < 2.47)$

$= 0.5 - 0.4932$

$= 6.8 \times 10^{-3}$

7) During an election campaign, 70% of a population of voters are in favor of a food quality control proposal. A sample of 10 voters were selected at random from the population

a) what will be the probability that:

Probability to vote in favor $= P(V) = 0.7$

i. exactly 4 voters are in favor

(2 pts)

$P(X=4) = {}_{10}C_4 (0.7)^4 (0.3)^6$ $\quad n = 10$ $\quad X =$ no. of voters are in favor

$P = P(V) = 0.7$

$q = 1 - p = 0.3 = P(\bar{V})$

$Y =$ no. of voters are not in favor

ii. at least 2 voters are not in favor

(3 pts)

$P(Y \geq 2) = 1 - P(Y = 0, 1)$

$= 1 - [P(Y=0) + P(Y=1)]$

$= 1 - [{}_{10}C_0 (0.3)^0 (0.7)^{10} + {}_{10}C_1 (0.3)^1 (0.7)^9]$

iii. between 6 and 8 voters are in favor

(3 pts)

$P(6 < X < 8) = P(X = 7) = {}_{10}C_7 (0.7)^7 (0.3)^3$

iv. more than 3 voters are in favor given that at most 5 voters are in favor

(4 pts)

$P(X>3 \mid X \leq 5) = \frac{P(A \cap B)}{P(B)} = \frac{P(X = 4, 5)}{P(X \leq 5)}$ $\quad 1 - P(6,7,8,9,10)$

$P(X = 0, 1, 2, 3, 4, 5)$

$= \frac{{}_{10}C_4 (0.7)^4 (0.3)^6 + {}_{10}C_5 (0.7)^5 (0.3)^5}{{}_{10}C_0 (0.7)^0 (0.3)^{10} + {}_{10}C_1 (0.7)^1 (0.3)^9 + {}_{10}C_2 (0.7)^2 (0.3)^8 + {}_{10}C_3 (0.7)^3 (0.3)^7 + {}_{10}C_4 (0.7)^4 (0.3)^6 + {}_{10}C_5 (0.7)^5 (0.3)^5}$

v. no voter is in favor?

(3 pts)

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${}_{10}C_0 (0.7)^0 (0.3)^{10}$

b) In a sample space of 120 voters, what is the expected number of voters that are not in favor?

(2 pts)

$\mu = np = 120 \times 0.3 = 36$

c) In a sample of 150 voters, what is the standard deviation of voters that are in favor?

(2 pts)

$\sigma = \sqrt{npq} = \sqrt{150 \times 0.7 \times 0.3} = 5.6124 = \frac{3\sqrt{14}}{2}$

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8) In a small town of 100 adults, 60% are men. 20% of the men are nonsmoker, 10% of the women are moderate smokers, 15% of the women are heavy smokers and 36% of the adults are heavy smokers.

P(O) = moderate

a) Plot a table representing the distribution of adults in the small town

(4 pts)

non smoker	N	O	H	
M	12	18	30	60
W	30	4	6	40
Total	42	22	36	100

b) An adult is to be selected at random, what is the probability that this adult is:

i. a heavy smoker woman (2 pts)

$P(H) = \frac{36}{100}$

ii. a smoker (3 pts)

$P(S) = \frac{22+34}{100} = \frac{58}{100} = 1 - \frac{42}{100}$

iii. a nonsmoker or a woman (3 pts)

$P(N \cup W) = P(N) + P(W) - P(N \cap W)$

$= \frac{42}{100} + \frac{40}{100} - \frac{30}{100}$

$= \frac{13}{25}$

iv. neither a nonsmoker nor a woman (4 pts)

$P(\bar{N} \cap \bar{W}) = P(\overline{N \cup W})$

$= 1 - P(N \cup W)$

$= 1 - \frac{13}{25} = \frac{12}{25}$

v. a woman given that she is not a heavy smoker. (4 pts)

$P(W/\bar{H}) = \frac{P(W \cap \bar{H})}{P(\bar{H})} = \frac{P(W) - P(W \cap H)}{1 - P(H)}$

vi. are the events "is heavy smoker" and " is a nonsmoker woman" mutually exclusive? (2 pts)

$H \cap NW = \emptyset$ ⇒ mutually exclusive

vii. are the events "is a woman" and " is a nonsmoker " independent? (3 pts)

$P(W \cap N) = \frac{30}{100} = \frac{3}{10}$

$P(W) \times P(N) = \frac{40}{100} \times \frac{42}{100} = \frac{21}{125}$

$P(W \cap N) \neq P(W) \times P(N)$

they are dependent

c) If 4 adults are selected. What is the probability that one nonsmoker, 2 moderate smokers women and one heavy smoker man are selected? (3 pts)

$\frac{{}_{42}C_1 \times {}_{4}C_2 \times {}_{30}C_1}{{}_{100}C_4}$

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