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**STAT 213 (L05): Midterm Solutions**


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**Multiple Choice Answer**


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- White question set:

1. d 2. d 3. a 4. b 5. a 6. d 7. b 8. a 9. d 10. a 11. d 12. d 13. c 14. d 15. b

- Green question set:

1. a 2. c 3. d 4. b 5. c 6. d 7. c 8. a 9. d 10. c 11. c 12. a 13. c 14. d 15. c

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**Show your work**


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1. Census reports indicate that 48% of all adults are male, which 22% of all adults are unmarried. The percentage of adults who are male or unmarried or both is 57%.

Let  $M$  be the male,  $P(M) = 0.48$ , Let  $U$  be the unmarried,  $P(U) = 0.22$ ,  $P(M \cup U) = 0.57$

	$U$	$U^c$	
$M$	0.13	0.35	0.48
$M^c$	0.09	0.43	0.52
	0.22	0.78	1

- a. What proportion of adults are male and unmarried ? [1 marks]

$$P(M \cap U) = P(M) + P(U) - P(M \cup U) = 0.48 + 0.22 - 0.57 = 0.13$$

- b. What proportion of adults are married females ? [1 marks]

$$P(M^c \cap U^c) = 1 - P(M \cup U) = 0.43$$

- c. What proportion of males are married ? [1 marks]

$$P(U^c|M) = \frac{P(U^c \cap M)}{P(M)} = \frac{0.35}{0.48} = 0.7292$$

- d. Is marital status independent of gender ? [1 marks]

Since  $P(U^c|M) = 0.7292 \neq P(U^c) = 0.78$ , marital status is not independent of gender.

2. The following data consist of the ordered diameters (in cm) of the neoplasms removed from the breasts of twenty women with pure sarcomas.

0.5    1.2    2.1    2.5    2.5    3.0    3.8    4.0    4.2    4.5  
 5.0    5.0    5.0    5.0    6.0    6.5    7.0    8.0    9.5    13.0

If a boxplot were to be constructed for these data, would it contain any outliers ? If so, specify the values that are outliers, and indicate whether each is a mild or extreme outlier. [3 marks]

position  $Q_1 = 0.25 \times 21 = 5.25 \approx 5$ ,  $Q_1 = 2.5$

position  $Q_3 = 0.75 \times 21 = 15.75 \approx 16$ ,  $Q_3 = 6.5$

$$IQR = 6.5 - 2.5 = 4$$

$$\text{Lower inner fence: } Q_1 - 1.5 \times IQR = -3.5; \text{ Lower outer fence: } Q_1 - 3 \times IQR = -9.5$$

$$\text{Upper inner fence: } Q_3 + 1.5 \times IQR = 12.5; \text{ Upper outer fence: } Q_3 + 3 \times IQR = 18.5$$

the observation, 13 is a mild outlier.

3. In a certain city, 30% of the people are Conservatives, 50% are Liberals, and 20% are Independents. Records show that in the last city selection, 65% of Conservatives voted, 82% of the Liberals voted, and 50% of the Independents voted. If a person in the city is selected at random and it is learned that he voted in the last election, what is the probability that he is a Liberal ? [3 marks]

Let C be the conservatives, L be the Liberals, I be the Independents and V be the "voted".

$$P(C) = 0.3, P(L) = 0.5, P(I) = 0.2, P(V|C) = 0.65, P(V|L) = 0.82, P(V|I) = 0.5.$$

$$\text{Want } P(L|V) = \frac{P(L \cap V)}{P(V)}.$$

$$P(V) = P(C \cap V) + P(L \cap V) + P(I \cap V) = P(C)P(V|C) + P(L)P(V|L) + P(I)P(V|I)$$

$$P(L|V) = \frac{P(L \cap V)}{P(V)} = \frac{0.5 \times 0.82}{0.8 \times 0.65 + 0.5 \times 0.82 + 0.2 \times 0.5} = \frac{0.41}{0.705} = 0.582$$