Practice Exam by T. Arwa Bader

Q1 The following is the output of the times consumed by students to solve a quiz for biostatistics done by T. Arwa, read it carefully and then answer the questions:

Statistics

Variable	N	Mean	StDev	CoefVar	Minimum	Q1	Median	Q3	Maximum
Time (min)(xi)	18	12.081	0.389	3.22	11.520	11.732	12.120	12.352	12.800

The range and the inter-quartile range, respectively:

A) 12.12, 0.389 B) 1.28, 0.62 C) 0.62, 1.28 D) None

Q2 A medical research team wishes to assess the usefulness of a certain symptom (S) in diagnosing a particular disease (D). In a random sample, 780 persons with the disease, 760 had the symptom. In another independent random sample of 1380 persons without the disease, only 21 had the symptoms. Given that the disease prevalence in the population is 0.001, then the specificity of the symptom $P(\bar{S}\backslash\bar{D})$:

A) 0.985 B) 0.974 C) 0.0152 D) 0.9848

Q3 One of the following is the correct definition of biostatistics:

A) It is the branch of applied statistics that applies statistical methods to medical and biological problems.
B) It is concerning the development of new methods of statistical inference
C) It consists of information coming from observations, counts, measurements, or responses.
D) None

Q4 Serum cholesterol is an important risk factor for coronary disease. We can show that serum cholesterol is approximately normally distributed, with mean = 219 mg/dL and standard deviation = 50 mg/dL. If the clinically desirable range for cholesterol is < 200 mg/dL, What proportion of the general population having the desirable range?

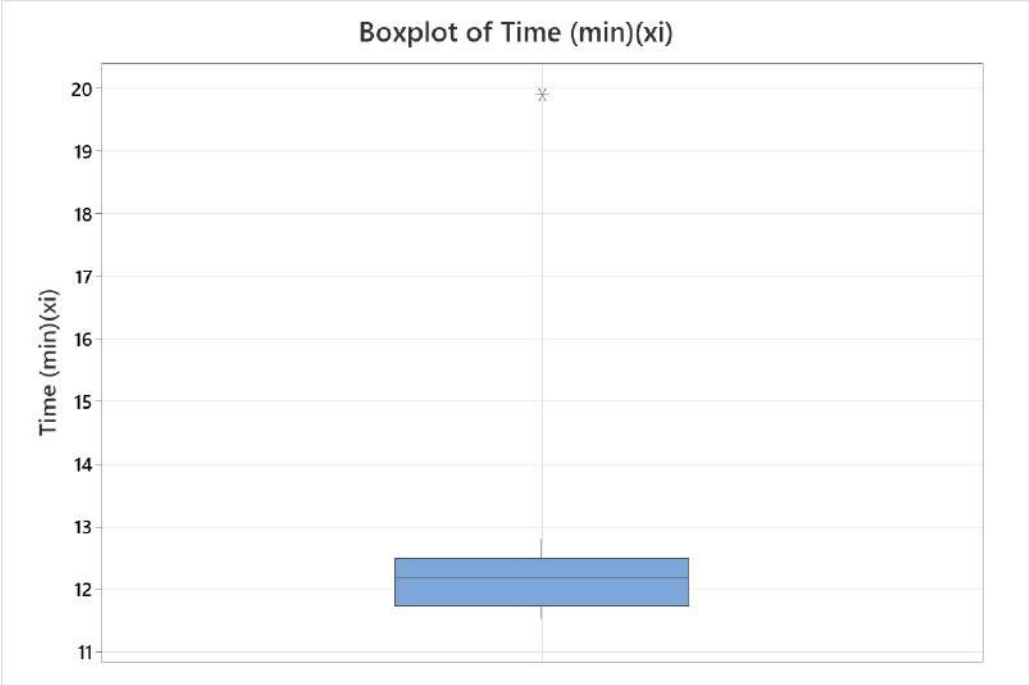
A) 0.3120 B) 0.6480 C) 0.7324 D) 0.62 E) 0.3520

Q5 Events A and B are independent if:

A) $P(A|B) = P(B)$ B) $P(A|B) = P(A) \times P(B)$

C) $P(A \cap B) = P(B) \times P(A \backslash B)$ D) $P(A \cap B) = P(A) \times P(B)$

Q6 4 The following is a box plot represents the times taken by an individual over 18 weeks, we can say there is an --------- which is ----- --------



A) Outlier, above the upper fence 29.
B) Outlier, above the upper fence 13.282.
C) No outliers, below the lower fence 12
D) Outliers, above the lower fence 13.

Q7 What is the best measure for this number of students 3,3,4,5,6,7,25?

A) Mean only B) Mode C) Median and mean

D) Median and mode E) Median only

Q8 let X ~ Bin (5, 0.4), then $P(X>2 \backslash x<5) =$

A) 0.0768 B) 0 C) 0.31 D) 0.9911

Q9 The following is the summary statistics for the serum levels before and after adopting a vegetarian diet, which of the following is a true statement:

Statistics

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Before	20	59.10	12.20	35.00	49.50	60.00	69.50	77.00
After	20	110.25	38.79	80.00	85.25	89.00	149.00	186.00

I) Data before has higher variability than data after.
II) Data after has a symmetric shape.
III) Data after has higher variability than data before.
IV) The range in before is 42 while the range in after is 106.

A) II only B) I and II C) III and IV D) IV only.

Q10 suppose that 25% of pregnant women (event G) suffer from anemia symptoms (event A) whereas only 10% of nonpregnant women suffer anemia symptoms. Suppose that in a group of 50 women, 20 are pregnant. assuming we select from this group a woman at random. Then the probability that she is not pregnant if she suffers anemia symptoms:

A) 0.4 B) 0.375 C) 0.7633 D) 0.9281

Q11 If the probability of contracting influenza is 35%, what is the probability that at least 3 out of 7 individuals will have influenza?

A) 0.07723 B) 0.567 C) 0.4677 D) 0.9227

Q12 If A1= {husband has diabetes} B1= {wife has diabetes} A2 = {husband has high blood pressure} B2 = { wife has high blood pressures} C = { husband has diabetes and does not have high blood pressure} D= { wife has at least one disease)}. What is the correct statement?

A) Event C = (A1 ∩ $\overline{A2}$) B) Event D = (B1 and B2)

C) Event A1 and A2 are always disjoint. E) C = (A1 and B2)

Q13 In a class, the heights of students are normally distributed with mean 165 and variance 25. If a student is selected randomly from this class, then the probability that his height is equal to 170?

A) 0.3413 B) 0.2357 C) 0.4082 D) 0.3112 E) Zero

Q14 A class has 100 students, where 30 of the students know how to play a musical instrument and 60 of these students are male. Of the male student, 20 can play musical instruments. Find the probability that a randomly selected student is a male or can play an instrument:

$A)0.30$ $B)0.90$ $C)$ 0.20 $D)$ 0.70 $E)$ 0.80

Q15 What is the best measure of location to use if the data set is as follows: (20.50,100,150,200,1000)

A) Range B) IQR C) Median D) Mode E) Variance

Q16 If the mean mark of 10 students is 15 and the standard deviation is 3. Malek, with mark 16 joined the class. the new mean and standard deviation; respectively is:

A) 2587, 166 B) 15.1, 8.19 C) 150, 8.19 D) 15.1, 2.86

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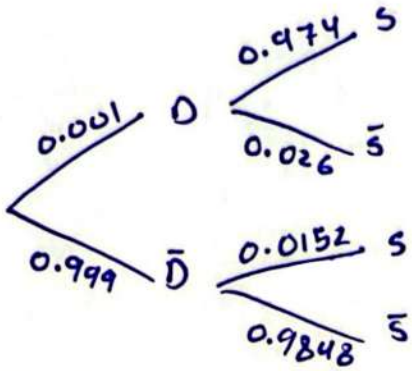
Answers e-

Q_1 Range = Max - Min = 12.8 - 11.52 = 1.28

IQR = $Q_3 - Q_1$ = 12.352 - 11.732 = 0.62 → (B)

Q_2



$P(S|D) = \frac{760}{780} = 0.974$ $P(S|\bar{D}) = \frac{21}{1381} = 0.0152$

$P(D) = 0.001$

Specificity $P(\bar{S}|\bar{D}) = \frac{P(\bar{S} \cap \bar{D})}{P(\bar{D})} = \frac{0.999 \times 0.9848}{0.999} = 0.985$

↳ (A)

Q_3 → (A)

Q_4 $\mu = 219$, $\sigma = 50$

$P(X < 200) = P(\frac{X-\mu}{\sigma} < \frac{200-219}{50}) = P(Z < -0.38) = P(Z > 0.38$

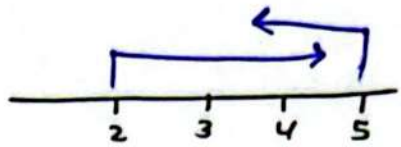
$= 0.3520$ ~ (E)

Q_5 → (D)

Q_6 outlier, above. 13.282 → (B)

Q_7 ~ (E)

Q8 $X \sim Bin(5, 0.4)$



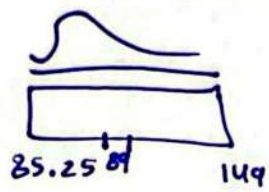
$P(X \geq 2 \mid X < 5)$

$= \dfrac{P(X=3) + P(X=4)}{P(X<5)}$ $\qquad \dfrac{0.0768 + 0.2304}{0.0778 + 0.2592 + 0.3456 + 0.2304 + 0.0762}$

$= 0.31 \rightarrow (C)$

Q9 I False. ∝ (By finding Range).

II



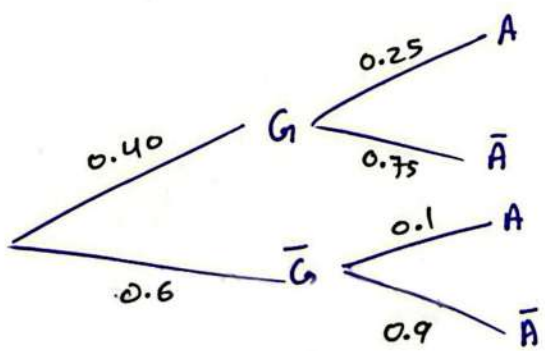
right False

III True

IV Range (B) = 77 − 35 = 42 True.

Range (A) = 186 − 80 = 106 ⇝ (C)

Q10 $P(G) = \frac{20}{50} = 0.4$



$P(\bar{G} \mid A) = \dfrac{P(\bar{G} \cap A)}{P(A)} = \dfrac{0.6 \times 0.1}{0.4 \times 0.25 + 0.6 \times 0.1} = 0.375$

↳ (B)

Q_{11} $p = 0.35$, $n = 7$

$$P(x \geq 3) = 1 - P(x < 3) = 1 - [P(x = 0,1,2)]$$

$$= 1 - [0.049 + 0.1848 + 0.2985] = 0.4677. \rightarrow (C)$$

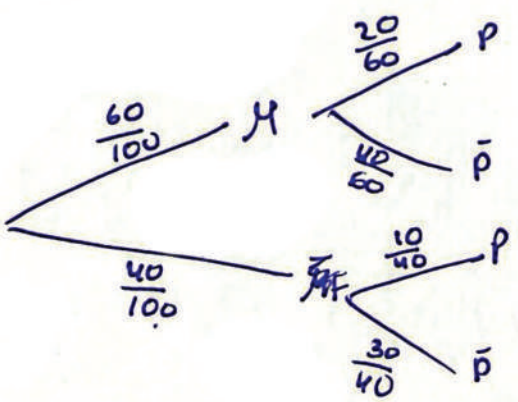
Q_{12}

$$C = A_1 \cap \bar{A}_2$$

$$D = B_1 \cup B_2 \rightsquigarrow (A)$$

Q_{13} $\mu = 165$, $\sigma^2 = 25$ $\quad P(X = 170) = 0 \rightsquigarrow (E)$

Q_{14}



$$P(M \cup P) = P(M) + P(P) - P(M \cap P)$$

$$= \frac{60}{100} + \left[\frac{60}{100} \times \frac{20}{60} + \frac{40}{100} \times \frac{10}{40}\right] - \frac{60}{100} \times \frac{20}{60} = 0.7 \rightarrow (D)$$

Q_{15} $\rightsquigarrow (C)$

Q_{16} $n = 10$, $\bar{x} = 15 \rightarrow \Sigma x = n \cdot \bar{x} = 10(15) = 150.$, $S = 3 \rightarrow S^2 = 9$

$\Sigma x_{new} = 150 + 16 = 166 \rightsquigarrow \bar{x}_{new} = \frac{166}{11} = \boxed{15.1}$

$$S^2 = \frac{\Sigma x^2}{n-1} - \frac{\Sigma x}{n(n-1)} \rightsquigarrow 9 = \frac{\Sigma x^2}{10-1} - \frac{(150)^2}{10(9)} \rightarrow \Sigma x^2 = 2331$$

$\Sigma x^2 = 2331 + 16^2 = 2587.$

$$s^2 = \frac{2587}{11-1} - \frac{(166)^2}{11(10)} = 8.19 \rightsquigarrow s = \sqrt{8.19} = 2.86 \rightsquigarrow (D)$$