Full Material Practice Exam by T. Arwa Bader

Q1 Suppose that a random sample of 60 observations was drawn from a population. The standardized observation as well as the observed frequency in each interval was counted as follows:

Intervals	Frequency	Probability
$Z \leq -1$	10	0.1587
$-1 < Z \leq 0$	30	0.3413
$0 < Z \leq 1$	15	0.3413
$Z > 1$	5	0.1587

Can we infer at the 10% significance level that the data were drawn from a normal distribution?

A) We reject H0 at the 10% significance level.
B) We can't reject H0 at the 10% significance level.
C) We can't conclude, there's no enough information.
D) None.

Q2 the following table gives the experience (in years) and monthly salaries (in terms of hundreds of JD's) of nine doctors selected randomly from JU hospital.

Person #	1	2	3	4	5	6	7	8	9
Experience	14	3	5	6	4	9	18	5	16
Salary	42	25	28	40	30	38	44	35	42

Knowing that $S_x^2 = 256.89, S_{xy} = 264, S_y^2 = 378$, the correlation coefficient for the above data.

A) 0.984 B) 0.847 C) 0.91 D) 0.123 E) None

Q3 for the following data set: 2,2,2,5,5,5,6,7,8,8,10,12,14,32,33

The best measure to use:

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

D)Median only E) Median and Mode.

Q4 The wights of children ages 2-3 years before and after taking vitamins are given by the following table, di = after – before

	After	Before	d_i	d_i^2
1	10.6	10.2	0.4	0.16
2	9.8	9.4	0.4	0.16
3	12.3	11.8	0.5	0.25
4	9.7	9.1	0.6	0.36
5	8.8	8.3	0.5	0.25
Total			2.4	1.18

Do the data in the table provide sufficient evidence to indicate a difference in the mean the wights before and after? Use 5% significance level for the test.

A) We reject H_0, if the test statistic > 2.132 and the test statistic $= 1.73$

B) We reject H_0, if the test statistic $> 2.776$and the test statistic $= 12.78$

C) We reject H_0, if the test statistic > 12.78 and the test statistic $= 2.776$

D) We reject H_0, if the test statistic > 1.833 and the test statistic $= 12.776$

E) We reject H_0, if the test statistic > 1.383 and the test statistic $= 1.58$

Q5 the following table gives the experience (in years) and monthly salaries (in terms of hundreds of JD's) of nine doctors selected randomly from JU hospital.

Person #	1	2	3	4	5	6	7	8	9
Experience	14	3	5	6	4	9	18	5	16
Salary	42	25	28	40	30	38	44	35	42

Knowing that $S_x^2 = 256.89, S_{xy} = 264, S_y^2 = 378$. Test the correlation coefficient is different from zero, using 5% significance level.

A) We don't reject H0, and the relationship doesn't exist.
B) We reject H0, and the relationship doesn't exist.
C) We reject H0, and the relationship exists.
D) We reject H0, and r is due to chance.

Q6 consider a random variable X with P.D.F given by the following, find the expected value:

X	-1	0	1	2	4
P(X)	0.01	0.04	C	0.45	0.2

A) 9.289 B) 0.3 C) 1.89 D) 2.89 E) 3.54

Q7 The following information represent 2 independent samples taken from normally distributed populations with unknown standard deviations.

Sample 1: 12, 10, 8, 6, 5, 9, 12, 11, 7, 8, 13, 7. With $\bar{X}1 = 9$, $S_1^2 = 2.59$

Sample 2: 14, 15, 14, 16, 8, 6, 4, 7. With $\bar{X}2 = 10.5$, $S_2^2 = 4.72$

A 99% confidence interval for the difference between the means.

A) 1.5 ± 2.878 B) 1.5 ± 2.43 C) 1.5 ± 2.88 D) -1.5 ± 2.878

Q8 suppose that 90% of the students pass calculus 101. In a sample of 200 students taking calculus 101, what is the probability that the sample proportion of passing students will be between 88% and 93%?

A) 0.9821 B) 0.1736 C) 0.7471 D) 0.1342 E) 0.1234

Q9 In a comparative study done by T. Arwa of males and females with regard the rate of smoking vape, 150 people were asked whether they are smoking or not, the table below summarizes the results from the study. Test P1-P2 is different from 0. Using 10% significance level. Use Z not corrected test.

	Males	Females
Number of smokers	45	25
Number of non-smokers	35	45
Total	80	70

A) We reject H_0, and the test statistic $= 1.96$

B) We reject H_0, and the test statistic $= 1.64$

C) We reject H_0, and the test statistic $= 2.523$

D) We reject H_0, and the test statistic $= -2.533$

E) We reject H_0, and the test statistic $= 2.19$

Q10 suppose that we want to estimate the mean for a normal population that has variance 25, by 95% C.I with error 0.6 using a random sample, the smallest sample size:

A) 102 B) 188 C) 267 D) 231 E) 162

Q11 let X~N(175, 16) be a random variable representing the heights of students currently enrolled in JU, find the probability that a randomly selected student will have height greater than 168 CM:

A) 0.9599 B) 0.025 C) 0.975 D)0.9995

Q12 Suppose that 35% of pregnant women suffer from anemia symptoms whereas only 7% of nonpregnant women suffer anemia symptoms. Suppose that in a group of 100 women, 60 are pregnant . assuming we select from this group a women at random, then the probability that she is pregnant if she suffers anemia symptoms:

A) 0.60 B) 0.88 C) 0.35 D) 0.25 E) 0.40

Q13 find $F_{0.90}(3,7)$:

A) 5.27 B) 0.1898 C) 0.3257 D) 3.07

Q14 If a random sample of size 100 are drawn form a population with mean 200 and variance 60, then the sampling distribution of $\bar{x}$ is approximately:

A) $N(2,0.6)$ $B)$ $N(200,0.6)$ $C)$ $N(200,60)$ $D)$ $N(200,6)$

Q15 One of the following statements is False:

A) Adding a constant value to each data point in a dataset will not change the standard deviation.

B) Cluster random sampling involves dividing a population into clusters or groups and then randomly selecting some of these clusters for the study.

C) The coefficient of variation is calculated by dividing the standard deviation by the mean.

D) If you decide to reject the null hypothesis, then you can support the alternative hypothesis.

E) When testing the difference between two sample proportions, We use Z test only when the normal approximation is satisfied for each of the two sample, that is: $n_1 \times P^* \times q^* < 5$ and $n_2 \times P^* \times q^* \geq 5$

Q16 Suppose P(A) = 0.90, P(B) = 0.40, P(A∪ B) = 0.94, then P(A\B):

A) 0.3797 B) 0.6750 C) 0.3038 D) 0.5063 E) 0.9000

Q17 In an experiment to determine the effect of nutrition on the attention spans of elementary school students, a group of 15 students were randomly assigned to each of 3 meal plans: (no breakfast, light breakfast, and full breakfast). Their attention spans (in minutes) were recorded during a morning period are shown in the table below:

No breakfast	Light breakfast	Full breakfast
8	14	10
7	16	12
9	12	16
13	17	15
10	11	12
$\bar{X}_1 = 9.4$ $S_1^2 = 5.3$	$\bar{X}_2 = 14$ $S_2^2 = 6.5$	$\bar{X}_3 = 13$ $S_3^2 = 6$

1) Calculate the grand mean for the data.

   A) 9.50 B) 12.13 C) 10 D) 11.9

2) The between mean square (MSB), and within mean square (MSW). Respectively:

   A) 58.534, 71.2 B) 29.267, 71.2 C) 29.267, 5.933 D) 58.534, 5.7

Q18 let MSB = 67.2 and MSW = 45.12, find F test.

A) 1.49 B) 0.203 C) 0.671 D) 29.598

Q19 The probability of success for a surgery is 30%. If this surgery is performed on 14 patients, then the probability that this surgery will be successful on at most 2 patients is:

(A) 0.382 (B) 0.0068 (C) 0.046 (D) 0.055 (E) 0.16084

Q20 A random sample of 100 people showed 40 smokers. In such a case the 95% Confidence interval for the population proportion of smokers p is:

A) $0.304 < p < 0.496$ $B)$ $0.285 < p < 0.475$ $C)$ $0.266 < p < 0.454$

D) $0.247 < p < 0.433$ $E)0.229 < p < 0.411$

Full exam solutions :-

Q1

freq (O)	prob.	Exp.
10	0.1587	9.522
30	0.3413	20.478
15	0.3413	20.478
5	0.1587	9.522

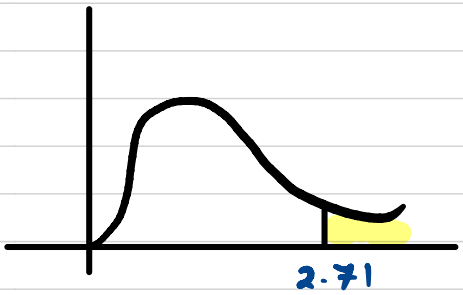
$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(10-9.522)^2}{9.522} + \frac{(30-20.478)^2}{20.478} + \frac{(15-20.478)^2}{20.478} + \frac{(5-9.522)^2}{9.522}$$

$$= 0.024 + 4.428 + 1.465 + 2.147 = 8.06$$

d.f = # of cat − 3 = 4 − 3 = 1.

$\chi^2_{0.90}(1) = 2.71$

∴ we rej H_0 (A)



Q2 $S_x = \sqrt{256.89} = 16.028$

$S_y = \sqrt{378} = 19.44$

$r = \frac{S_{xy}}{S_x \cdot S_y} = \frac{264}{19.44 \times 16.028} = 0.847$ (B)

Q3 (D)

Q4 $\bar{d} = \frac{\sum d_i}{n} = \frac{2.4}{5} = 0.48$.

$$s_d = \sqrt{\frac{\sum d_i^2}{n-1} - \frac{(\sum d_i)^2}{n(n-1)}} = \sqrt{\frac{1.18}{4} - \frac{(2.4)^2}{5(4)}} = 0.084.$$

$$t = \frac{\bar{d}}{s_d/\sqrt{n}} = \frac{0.48}{0.084/\sqrt{5}} = 12.78.$$

$\frac{\alpha}{2} = \frac{0.05}{2} \rightarrow \alpha_{/2} = 0.025 \rightarrow t_{0.975}(4) = 2.776.$

$\therefore$ rej H_0 → (B)

Q5 $S_x = \sqrt{256.89} = 16.028$ & $S_y = \sqrt{378} = 19.44$

$$r = \frac{S_{xy}}{S_x \cdot S_y} = \frac{264}{19.44 \times 16.028} = 0.847$$

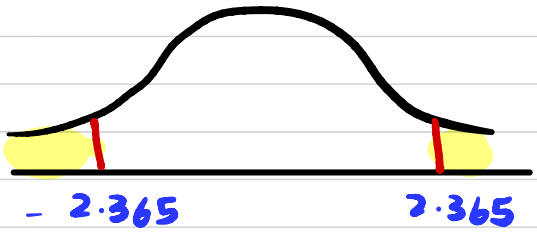
$H_0: \rho = 0$ vs $H_1: \rho \neq 0$.

$$t = r\sqrt{\frac{n-2}{1-r^2}} = 0.847\sqrt{\frac{9-2}{1-(0.847)^2}} = 4.216$$

$\frac{\alpha}{2} = \frac{0.05}{2} \rightarrow \alpha_{/2} = 0.025$ & $1 - 0.025 = 0.975$

$d.f = 9-2 = 7 \rightarrow t_{0.975}(7) = 2.365$

$\therefore$ we rej H_0 (C)



Q6

x	-1	0	1	2	4
p(x)	0.01	0.04	C	0.45	0.2

$\sum p(x) = 1 \Rightarrow 0.01 + 0.04 + C + 0.45 + 0.2 = 1$

$\therefore C = 0.3.$

$E(x) = \sum x \cdot p(x) = -1(0.01) + 0(0.04) + 1(0.3) + 2(0.45) + 4(0.2) = 2.89$

→ (D)

Q7 $s_p = \sqrt{\frac{(n-1)s_1^2 + (m-1)s_2^2}{n+m-2}} = \sqrt{\frac{(12-1)\,2.59 + (8-1)\,4.72}{12+8-2}} = 1.849$

$df = 12+8-2 = 18 \qquad t_{0.995}(18) = 2.878$

$$\bar{x} - \bar{y} \pm t_{\alpha/2} \cdot (s_p) \cdot \sqrt{\frac{1}{n} + \frac{1}{m}}$$

$$9 - 10.5 \pm 2.878 \cdot (1.849)\sqrt{\frac{1}{12} + \frac{1}{8}} \Rightarrow -1.5 \pm 2.43.$$ (D)

Q8 $n = 200 \qquad p = 0.90$

$$P(0.88 < \hat{p} < 0.93) = P\left(\frac{0.88 - 0.90}{\sqrt{\frac{0.90(0.10)}{200}}} < z < \frac{0.93 - 0.90}{\sqrt{\frac{0.90(0.10)}{200}}}\right)$$

$$= P(-0.94 < z < 1.41) = P(z < 1.41) - P(z < -0.94)$$
$$= 0.9207 - 0.1736 = 0.7471$$ (C)

Q9 ① $n_1 = 80$, $x_1 = 45 \rightarrow \hat{p}_1 = \frac{45}{80} = 0.563$

② $n_2 = 70$, $x_2 = 25 \rightarrow \hat{p}_2 = \frac{25}{70} = 0.357$

$$p^* = \frac{x_1 + x_2}{n_1 + n_2} = \frac{45+25}{80+70} = 0.467 \rightarrow q^* = 0.533$$

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p^* q^* \sqrt{\frac{1}{n} + \frac{1}{m}}}} = \frac{0.563 - 0.357}{\sqrt{0.467(0.533)}\sqrt{\frac{1}{80} + \frac{1}{70}}} = 2.523$$

$\frac{\alpha}{2} = \frac{0.10}{2} \rightarrow \alpha_{/2} = 0.05 \rightarrow 1 - 0.05 = 0.95$

$\therefore$ we rej H_0. → (C)

Q10 if 95% CI → $z = 1.96$, $\sigma^2 = 25 \rightarrow \sigma = 5$

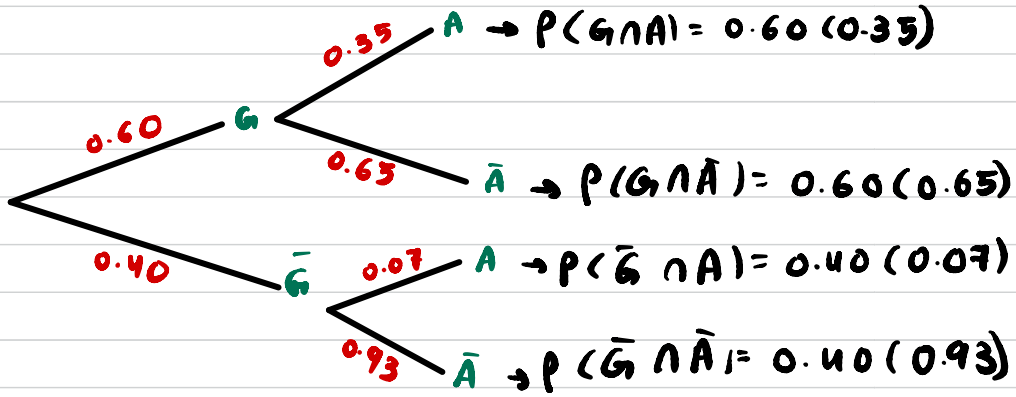
$$n = \left(z_{\alpha/2} \cdot \frac{\sigma}{E}\right)^2 = \left(\frac{1.96 \cdot (5)}{0.6}\right)^2 = 266.7 \approx 267 \rightarrow$$ (C)

Q11 $\mu = 175,\ \sigma^2 = 16 \rightarrow \sigma = 4$

$$P(x > 168) = P\left(\frac{x-\mu}{\sigma} > \frac{168-175}{4}\right) = P(z > -1.75)$$

$$= P(z < 1.75) = 0.9599 \rightarrow \text{(A)}$$

Q12



$$P(G \mid A) = \frac{P(G \cap A)}{P(A)} = \frac{0.60(0.35)}{0.60(0.35) + 0.40(0.07)} = 0.88. \rightarrow \text{(B)}$$

Q13 $F_{0.90}(3,71) = 3.07 \rightarrow \text{(D)}$

Q14 $n = 100,\ \mu = 200,\ \sigma^2 = 60$

$$\bar{x} \sim N\left(\mu, \frac{\sigma^2}{n}\right) = N\left(200, \frac{60}{100}\right) = N(200, 0.60) \rightarrow \text{(B)}$$

Q15 (E)

Q16 $P(A) = 0.90,\ P(B) = 0.40,\ P(A \cup B) = 0.94$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$0.94 = 0.90 + 0.40 - P(A \cap B)$$
$$\therefore P(A \cap B) = 0.36$$

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)} = \frac{0.36}{0.40} = 0.90 \rightarrow \text{(E)}$$

Q17

1) $\bar{X}_G = \frac{\sum x_i}{N} = \frac{8+7+\cdots+14+16+\cdots+15+12}{15} = 12.13$ → (B)

2) $MSB = \frac{\sum n_i(\bar{x}_i - \bar{X}_G)^2}{K-1}$

$= \frac{5(9.4-12.13)^2 + 5(14-12.13)^2 + 5(13-12.13)^2}{3-1}$

$= 29.267$

$MSW = \frac{\sum(n_i-1)s_i^2}{N-K} = \frac{4(5.3)+4(6.5)+4(6)}{15-3}$

$= 5.933$ → (C)

Q18

$F = \frac{MSB}{MSW} = \frac{67.2}{45.12} = 1.49$ → (A)

Q19 $p = 0.30$, $n = 14$ → Binomial

$P(x \le 2) = 0.1608$ → (E)

Q20 $n = 100$, $x = 40$ → $\hat{p} = 0.40$ & $z_{\alpha/2} = 1.96$

$\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 0.40 \pm 1.96\sqrt{\frac{0.40(0.60)}{100}}$

$(0.304, 0.496)$ → (A)

وهيك بنكون خلصنا طلسي بخص المادة :)

Arwa. M. Bader