FINAL
STAT 236

جامعة بيرزيت

Math. & Comp. Science Dept.
STAT 236

Final Exam — Fall 98/1999

Instructors : Dr. Fathi Allan
Dr. Faisal Awartani

Student Name : Ibraheem Selem .... No. :................ Section:......

(1) Its seen from the labor force survey conducted by the Palestinian central bureau of statistics, we have 15% of adult women in the labor force. While 65% of adult men are in the labor force. Assume that the percentage of adult women in the Palestinian society is 45% and therefore the percentage of adult men is 55%.

a) find the percentage of adults in the Labor force.

b) If a person is randomly selected and it was found that this person is in the labor force, find the probability that this person is a female

adult women/L 15% ~~ ~~ in palestine 45%
adult men/L 65% in palestine 55%

(a) percentage of adult in labor. 15% + 65% = 80%

Q#2: If $P(A) = 0.3$, $P(B) = 0.4$. Find $P(A \cup B)$ in the following cases

(a) If A and B are independent

(b) If B and B are mutually exclusive.

~~P(A)~~ $P(A/B) = P(A)$ when it $\boxed{\text{indepent}}$

(a) $P(A/B) = \dfrac{P(A \cap B)}{P(B)} = P(A)$ *

~~P(A∩B)~~ $\boxed{P(A \cap B) = P(A)\,P(B)}$

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

$= 0.3 + 0.4 - (0.3 \times 0.4)$

$= 0.7 - 0.12$

$= 0.58$

(b) when mutual excelsive $= P(A \cap B) = 0$

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

$= 0.3 + 0.4 - 0$

$= 0.7$

Q#3: A sample of 400 households from the West Bank and Gaza were asked if they were connected with the telephone network and if they own a computer or not. The answers of the survey are summarized in the following table:

		owns a computer Yes	No
Do you have a telephone connection?	Yes	16	144
	No	24	216

a) Find the probability a household owns a computer?

b) If a household is connected with the telephone network, find the probability that the household owns a computer.

c) Find the probability that a household owns a computer and connected with the telephone network at the same time.

d) Are the events of computer ownership and telephone connection independent? Explain your answer.

e) An Internet company is interested in estimating their potential market in Palestine among households. As you might know, a household can be eligible for Internet connection if it is connected with the telephone network and owns a computer at the same time. Knowing that we have 440,407 households in Palestine, estimate the size of the potential market for the Internet Company.

marginal proplity Table

Tele \ Comp	yes	No	Total
yes	16	144	160
No	24	216	240
Total	40	360	400

(a) $p(\text{own computer}) = \frac{40}{400} = 0.1$

(b) $p(\text{ownComp} / \text{Tele}) = \frac{p(\text{ownComp} \cap \text{Tele})}{p(\text{tele})} = \frac{\frac{16}{400}}{\frac{160}{400}} = 0.1$

(c) $p(\text{Comp} \cap \text{Tele}) = \frac{16}{400} = 0.04$

(d) $p(\text{Comp} \cap \text{tele})$ must $p(\text{Comp}) \times p(\text{Tele}) = \frac{\cancel{160}}{400} \times$

$\frac{16}{400} = \frac{40}{400} \times \frac{160}{400} = \frac{240}{400}$

$\frac{16}{400} \neq \frac{240}{400}$ — so not Idependent.

Q# 4: A sample of 20 students from BZU produced a GPA (Grade Point Average) of 78 and standard deviation of 5 points.

(a) Construct 95% confidence interval for the GPA of BZU students.

(b) What is the error in your estimation.

(c) If the error is to be less than 1 point what would be the sample size.

(a) $C = 1 - \alpha$

$95\% = 1 - 5\%$

$\alpha = 5\%$

$E \Rightarrow t_{\alpha/2} \frac{S}{\sqrt{n}}$ → error

$t = \frac{x - \mu}{\frac{S}{\sqrt{n}}}$

(b) $\bar{X} \mp E$ is interval

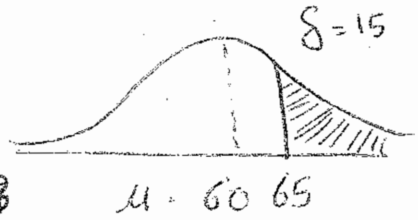
$n = \frac{t_{\alpha/2}^2 \, \delta^2}{E^2}$

Q#5: The wages of Palestinian workers according to the Palestinian central bearue of statistics has a mean of 60 NIS per day with standard deviation of 15 NIS. Find:

a) The percentage of workers with wages above 65 NIS.

b) Between 50 and 72 NIS.

c) The workers with lower 5% of the wages are considered poor. And those with the upper 5% of the wages are considered rich. Find the wage below which a worker is considered poor and above which the worker is considered rich.



(a) $Z = \dfrac{X - \bar{X}}{\delta} = \dfrac{65-60}{15} = \dfrac{5}{15} = 0.33$

$P(0.33) =$ area 0.1293

above 65 $= 0.5 - \cancel{0.2486} = \cancel{0.2514}$ 0.3707

(b) $Z_1 = \dfrac{X - X}{\delta} = \dfrac{50-60}{15} = \dfrac{-10}{15} = -0.67$

$Z_2 = \dfrac{X - \bar{X}}{\delta} = \dfrac{72-60}{15} = \dfrac{12}{15} = 0.8$

$P(-0.67 < Z < 0.8) = 0.2881 + 0.2486 = 0.5367$

(c) ↑ 5% more rich

↓ 5% less rich (poor)

$0.05 = \dfrac{X - 60}{15}$

$0.75 = X - 60$

$X = 60.75$ NIS

less poor

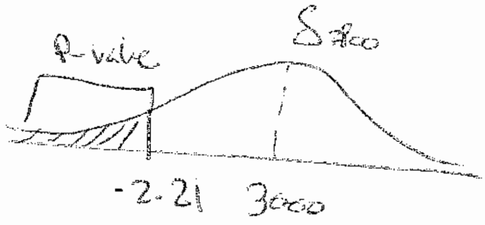
above rich

5- A company claims that a certain electrical component they produce is designed to provide a mean service life of 3000 hours, with a standard deviation of 800 hours. A customer group is interested in testing this claim. Hence a simple random sample of 50 components were tested and they produced a sample mean of 2750 hours. Does this provide sufficient evidence to indicate the mean life time is less than 3000 hours? Test using $\alpha=0.05$. What is the P-value of the test?

$\mu = 3000$ $\quad \delta = 800$ $\quad n = 50$ $\quad \bar{X} = 2750$ $\quad \alpha = 0.05$

Ho $\mu = 3000$

Ha $\mu < 3000$



$$\frac{X-\mu}{\delta_{\bar{x}}} = \frac{2750 - 3000}{113.4} = -2.21$$

$$\delta_{\bar{x}} = \frac{\delta}{\sqrt{n}} = \frac{800}{\sqrt{50}} =$$

$P(-2.21) = 0.4864$

$= 0.5 - .4864 = \boxed{0.0136}$ The p-value

6- A researcher is trying to estimate the average length of stay of patients in a certain hospital. Suppose that the standard deviation of length of stay of patients in the hospital is known to be 1.5 days. What would be the sample needed for estimating the average length of stay with a margin of error E=0.2 days assuming

a) 95% confidence level

b) 99% confidence level.

c) If the researcher have 3 days standard deviation for the length of stay instead of 1.5 days. What would be the sample size?

$C = 1 - \alpha$

$\%.95 = 1 - \alpha$

$\alpha = 5\%$

$$E = Z_{\alpha/2} \frac{S}{\sqrt{n}}$$

$$E^2 = \frac{Z_{\alpha/2}^2 \, \delta^2}{n}$$

$$n = \frac{Z_\alpha^2 \, \delta^2}{E^2} \Rightarrow \frac{(1.96)^2 (1.5)^2}{(0.2)^2}$$

$n = 216$

$H_a: \mu \leq 75$

$H_a: \mu > 75$

8- The mean GPA of BZU students in 1994 was 75. If a sample of 20 students produced a GPA of 78 and a standard deviation of 5 points. Suppose that the GPAs of students are normally distributed, can we conclude that the GPA of BZU students has increased. Test this claim using 0.05 level of significance.

$\mu = 75 \quad n = 20 \quad \alpha = 0.05 \quad \bar{X} = 78 \quad S = 5$

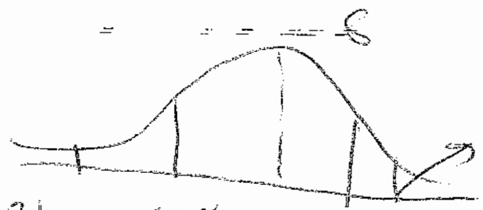
Test statistic $= t_{\alpha/2}$

$t = \dfrac{78-75}{1.12} = \dfrac{3}{1.12} = \underline{2.68}$

$S_{\bar{x}} = \dfrac{S}{\sqrt{n}} = \dfrac{5}{\sqrt{20}} \quad 1.12$

$dF = n-1 \Rightarrow 20-1 = \underline{19}$

$t_{0.025} = 0.6876$



dont Reject Ho.

9- If production process claims that the percentage of defective components is usually 10%. If the percentage of defectives exceeds 10% the production process will be shut down for calibration. A quality control inspector obtained a 20 defective components in a random sample of 80 components from the production process. Does the quality control inspector have enough evidence to shut down the production line? Test your hypothesis using 0.05 significance level. What is the P-value of the test?

$\pi = 0.1$

$p = \frac{20}{80} = 0.25$

$n = 80$

$\alpha = 0.05$

$H_0: \pi \leq 10$

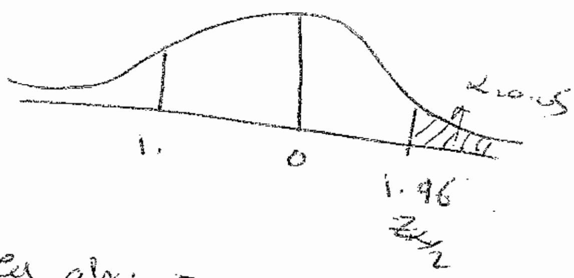
$H_a: \pi > 10$

$S_p = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.1(0.9)}{80}}$

$S_p = 0.034$

$Z = \frac{p - \pi}{S_p} = \frac{0.25 - 0.10}{0.034} =$

$Z_{0.025}$



P-value ⇒ area above Z statistic