97.5 Excellent

BIRZEIT UNIVERSITY
MATHEMATICS DEPARTMENT

Midterm Exam **Stat 236** **Summer I 2012**

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Sample standard deviation:

$$s=\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}=\sqrt{\frac{\sum x^2-\frac{(\sum x)^2}{n}}{n-1}}=\sqrt{\frac{\sum x^2-n(\bar{x})^2}{n-1}}$$

Z – Score: $z=\dfrac{x-\mu}{\sigma}$

Covariance: $s_{xy}=\dfrac{\sum(x-\bar{x})(y-\bar{y})}{n-1}$

Correlation coefficient: $r=\dfrac{s_{xy}}{s_x s_y}=\dfrac{n(\sum xy)-(\sum x)(\sum y)}{\sqrt{n\sum x^2-(\sum x)^2}\sqrt{n\sum y^2-(\sum y)^2}}$

Permutations: $n\Pr=\dfrac{n!}{(n-r)!}$

Combinations: $nC\,r=\dfrac{n!}{(n-r)!r!}$

Conditional probability: $p(A\setminus B)=\dfrac{p(A\cap B)}{p(B)}$

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

Discrete Random Variable

$$E(X)=\mu=\sum xf(x)$$

$$Var(X)=\sum(x-\mu))^2 f(x)$$

Binomial Probability Distribution

$$P(X=x)=\binom{n}{x}p^x(q)^{n-x} \qquad q=1-p$$

$E(X) = np$, $\sigma(X)=\sqrt{np(1-p)}$

- **Poisson Probability**

$$f(x)=\frac{\mu^x e^{-\mu}}{x!}$$

42

87544 87552

$$\frac{(12)(7299.5)-(96)(912)}{\sqrt{12(870)-(96)^2}\sqrt{12(69524)-(92)^2}}$$

10440

9216

1224

834288

831744

2544

$S^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1} = \frac{870 - \frac{(96)^2}{12}}{11} = \frac{870 - \dots}{11}$

$\sqrt{9.2} = 3.04$

(1 – 8)A survey was conducted about a" No smoking "policy at BZU. The students were asked whether they were in favor of (identified by 1) or against (identified by 2) indoor smoking, about monthly expenditure and cumulative average. The following is a sample of the results:

Student #	Gender	No smoking Policy	X =Expenditure (NIS)	Y=Cumulative Average
1.	Male	1	4.5 ~~9~~	83
2.	Male	2	5.5 ~~8~~	~~75~~
3.	Female	2	6 ~~7.5~~	~~70~~
4.	Female	1	6.5 ~~5.5~~	~~74~~
5.	Male	2	7 ~~4.5~~	~~70~~
6.	Female	1	7.5 16.5	~~72~~
7.	Female	1	7.5 ~~7.5~~	82
8.	Male	2	9 ~~9.5~~	~~78~~
9.	Male	2	8.5 ~~6.5~~	~~73~~
10	Female	1	9 ~~7~~	~~77~~
11.	Male	1	9.5 ~~6~~	~~78~~
12.	Female	1	16.5 ~~8.5~~	80

[Hint: $\sum y = 912$, $\sum y^2 = 69524$, $\sum x = 96$, $\sum x^2 = 870$, and $\sum xy = 7299.5$]

70, 70, 72, 73, 74, 75, 77, 78, 78, 80, 82, 83

$x - \bar{x}$	
−6	36
−6	36
−4	16
−3	9
−2	4
−1	1
1	1
2	4
2	4
4	16
6	36
7	49

To 212

For the variable "**Cumulative Average**", find

1. The mean, median, and mode.

$\bar{x} = \frac{\sum x}{n} = \frac{912}{12} = 76$

median $\frac{12}{2} \to 6, 7$

mediaian $= \frac{75+77}{2} = 76$

mode $= 78, 70$

2. The coefficient of variation

$CV = \frac{S.d}{mean} \times 100$

$= \frac{3.04}{76} \times 100 = 4.006$

$S.d = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} = \sqrt{\frac{212}{11}} = \sqrt{19.3} = 4.4$

For the variable "**Expenditure**", find

3. The five number summary

$\Rightarrow$ sumy. 4.5, 6.25, 7.5, 8.75, 16.5

$Q_1 = .25 \times 12 = 3, 4 \to 6, 6.5 \to \frac{6+6.5}{2} = 6.25$

$Q_2 = .50 \times 12 = 6, 7 \to 7.5, 7.5 \to \frac{7.5+7.5}{2} = 7.5$

$Q_3 = .75 \times 12 = 9, 10 \to 8.5, 9 \to \frac{8.5+9}{2} = 8.75$

4. The limits of the box plot. Is there any outliers?

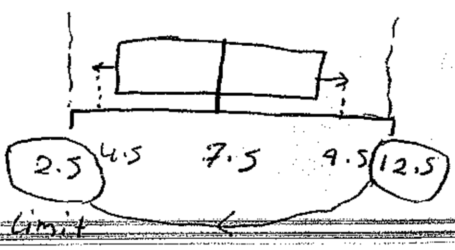
$IQR = Q_3 - Q_1 = 8.75 - 6.25 = 2.5$

$1.5 \times IQR = 3.75$

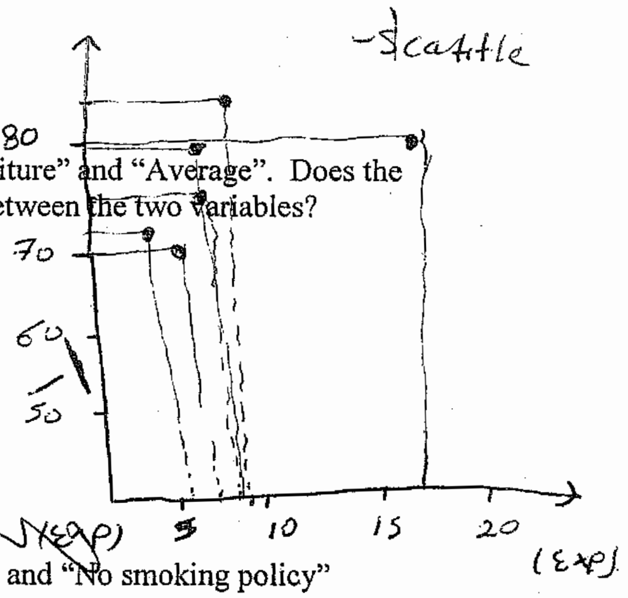
$Q_1 - 3.75 = 2.5$ $\quad Q_3 + 3.75 = 12.5$

Limit

Extrem $= 16.5$



5. Construct a **scatter diagram** for the two variables "Expenditure" and "Average". Does the scatter diagram give an indication about the **relationship** between the two variables?



$\frac{\sum (x-\bar{x})(y-\bar{y})}{n-1}$

positive relation ship

6. Construct a **crosstabulation** for the two variables "Gender" and "No smoking policy"

Gender \ No smok	1	2	Total
male	2	4	6
femal	5	1	6
Total	7	5	12

7. Find the probability that a randomly selected student is a male or he is against indoor smoking.

$P(M \cup 2) = P(M) + P(2) - P(M \cap 2)$

$= \frac{1}{2}\frac{6}{12} + \frac{5}{12} - \frac{4}{12} = 0.5 + 0.42 - 0.33$

$= 0.59$

8. Are the two variables "Gender" and "No smoking policy" **independent**. Explain using probability male against smok

$P(M \cap 2) = P(M) \times P(2)$

$0.33 \neq 0.5 \times 0.42$ they are dependent

9. A six-sided die is tossed 3 times. Find the probability of observing **three ones** in a row

$\# S = 6^3 = 216$

$P(1,1,1) = \frac{1}{216}$

10. If P (A) = 0.5, P (B) = 0.4, and P (A ∪ B) = 0.88, find P (B/A)? Are A, B **independent**?

$P(B/A) = \frac{P(B \cap A)}{P(A)} = \frac{0.02}{0.5} = 0.04$

$P(A \cup B) =$

$0.88 = P(A) + P(B) - P(A \cap B)$

$0.5 + 0.4 -$

$0.88 = 0.9 - (P(A \cap B))$

$P(A \cap B) = 0.02$

11. A sample of the monthly amounts spent for food by BZU students has a symmetric distribution. The sample mean is \$100 and the standard deviation is \$10. Find the percent of the monthly food expenditures less than \$120 is

س11

$P \quad 1 - \frac{1}{2^2} =$

كل الي في هاد الشكل

اكثر من اكثر

هنا

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

$0.02 = 0.5 \times 0.4$

$0.02 \neq 0.2$ they are dependent

(12 – 13) A sample of 100 BZU students was asked how many cups of coffee they drink in the morning. You are given the following sample information.

Cups of Coffee	Frequency	$f(x)$	$x\,f(x)$
0	10	$\frac{10}{100}$	0
1	40	$\frac{40}{100}$	0.4
2	20	$\frac{20}{100}$	0.4
3	30	$\frac{30}{100}$	0.9
			1.7

12. Find the probability that a selected random person drunk at **least 1** cup of coffee in a morning.

$P(x \geq 1) = P(1) + P(2) + P(3)$

$1 - P(x<1) = 1 - P(0) = 1 - 0.1 = 0.9$

13. Find the **expected number** of drunk cups of coffee.

$E(x) = \sum x f(x)$

$= 1.7$

%10 defective

(14 – 16)A production process produces 90% **non-defective** parts.

14. If a sample of 10 parts from the production process is selected. What is the probability that the sample will contain at least 4 **defective** parts?

$P(x \geq 4) = 1 - P(x<4)$

$= 1 - (f(3) + f(2) + f(1) + f(0))$

$= 1 - \left[\binom{10}{3}(0.1)^3(0.9)^7 + \binom{10}{2}(0.1)^2(0.9)^8 + \binom{10}{1}(0.1)^1(0.\right.$

$\left. + \binom{10}{0}(0.1)^0(0.9)^{10}\right]$

15. If a sample of **15 parts** from the production process is selected. What is the probability that the sample will contain 7 **non-defective** parts?

$P(x=7) = f(7)$

$= \binom{15}{7}(0.9)^7(0.1)^8$

16. If a sample of **2500 parts** from the production process is selected. What is the expected number and the standard deviation of the **defective** parts.

$E(p) = np$

$= 2500 \times 0.1 = 250$

$s.d = \sqrt{var}$

$var = \sqrt{np(1-p)} =$

$= \sqrt{250\,(0.9)} = \sqrt{225} = 15$

$\mu = 8$ $\qquad 8 \rightarrow$ hour

(17 – 20) Ramallah Hospital has noted that they admit an average of 8 patients per hour.

17. What is the probability that during the next hour **less then** 3 patients will be admitted?

$$P(x<3) = P(2) + P(1) + P(0)$$
$$= \frac{8^2 e^{-8}}{2!} + \frac{8^1 e^{-8}}{1!} + \frac{8^0 e^{-8}}{0!}$$

18. What is the probability that during the next half hour **exactly 5** patients will be admitted?

$$f(5) = \frac{4^5 e^{-4}}{5!} = 0.16$$

$8 \rightarrow$ hour
$?? \rightarrow \frac{1}{2}$
$\mu = 4$

19. What is the **expected number** of admitted patients in any given day?

Patien 8 $\leftarrow$ 1 hour
?? $\leftarrow$ 24 hour

\# of Patient = 192 patient

20. Which of the following is a discrete and which is a continuous variable?
   a. The volume of water released from a dam ___continuous___
   b. The distance you drove yesterday. ___continuous___
   c. The number of employees of an insurance company ___discreat___
   d. The amount of milk produced by a cow in one 24-hour period ___continuous___
   e. The number of gallons of milk sold at the local grocery store yesterday ___discrete___