

First

**BIRZEIT UNIVERSITY
MATHEMATICS DEPARTMENT**

First Exam

Stat 236

Spring 2012

Name (بالعربية).....

Number.....

Instructor.....

Sec.....

Sample standard deviation:

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

$$Z - \text{Score: } z = \frac{x - \mu}{\sigma}$$

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

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

$$\text{Permutations: } nPr = \frac{n!}{(n-r)!}$$

$$\text{Combinations: } nCr = \frac{n!}{(n-r)!r!}$$

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

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

10
09
08
08
35

Q#1(12 points)

Circle the correct answer :

- A study was done to determine the percentage of teenagers that own a car. The true percentage of teenagers that own a car is the:
 - statistic
 - population
 - variable
 - parameter
- Fifteen percent of the students in a school of Business Administration are majoring in Economics, 20% in Finance, 35% in Management, and 30% in Accounting. The graphical device(s) which can be used to present these data is (are)
 - a line graph
 - only a bar graph
 - only a pie chart
 - both a bar graph and a pie chart
- In a sample of 800 students in a university, 240, or 30%, are Business majors. The 30% is an example of
 - A sample
 - A population
 - Statistical inferences
 - Descriptive statistics
- For ease of data entry into a university database, 1 indicates that the student is a first year student, 2 indicates that the student is a second year student and so on. In this case data is
 - quantitative data
 - qualitative data
- Given the following information: Variance = 324, mean = 60 and median = 74. The coefficient of variation is
 - 54%
 - 30%
 - 0.30%
 - 5.4%

$$\sqrt{\text{var} = (s.d)^2} \quad CV = \frac{s.d}{\text{mean}} \times 100$$

$$\frac{\sqrt{324}}{60} \times 100 = \frac{18}{60} \times 100 = 30\%$$

6. During the past six months, the purchasing agent bought:

- 1200 tons of coal at \$28 a ton
- 3000 tons of coal at \$87 a ton
- 500 tons of coal at \$88 a ton

What is the mean price per ton?

- \$87.25
- \$68.47
- \$89.18
- \$72.04
- None of the above

$$1200 \times 28 = 33600$$

$$3000 \times 87 = 261000$$

$$500 \times 88 = 44000$$

$$\frac{33600 + 261000 + 44000}{1200 + 3000 + 500} = \frac{338600}{4700} = 72.04$$

7. Two events, A and B, are mutually exclusive and each have a nonzero probability. If event A is known to occur, the probability of the occurrence of event B is

- a. Zero
- b. 1
- c. Any positive value
- d. Any value between zero and 1

$$P(A \cap B) = 0$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0}{P(A)} = 0$$

8. If A and B are independent events with $P(A) = 0.65$ and $P(A \cap B) = 0.26$, then, $P(B) =$

- a. 0.4
- b. 0.169
- c. 0.39
- d. 0.65

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

$$0.26 = \frac{0.65}{0.6}$$

9. According to Chebyshev's Theorem, what percent of the observations lie within plus and minus 1.5 standard deviations of the mean?

- a. 56 percent
- b. 95 percent
- c. 67 percent
- d. Cannot compute because it depends on the shape of the distribution



10. A sample of assistant professors incomes has a symmetric distribution with mean income of \$32,000 and a standard deviation of \$3,000., what is the percentage of faculty that earn more than \$26,000?

- a. 84%
- b. 2.5%
- c. 97.5%
- d. 100%
- e. None of the above

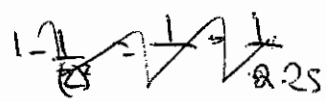
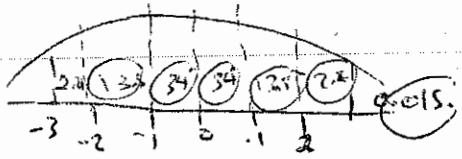
$$Z_{26000} = \frac{26000 - 32000}{3000} = -2$$

11. From a group of seven finalists to a contest, three individuals are to be selected for the first and second and third places. Determine the number of possible selections.

$$P = \frac{7!}{(7-3)!} = \frac{7!}{4!} = 7 \cdot 6 \cdot 5 = 210$$

12. A game is conducted using four boxes. Each box contains chips numbered from 0 to 9. One chip is selected at random from each box. find The total number of sample points in the sample space

$$10 \times 10 \times 10 \times 10 = 10^4$$



$$1 - \frac{1}{2^2} = ??$$

$$1 - \frac{1}{2 \cdot 25}$$

Q# 2: (12 points)

Eight people from your stat 236 class were taken and gave the following information:

- Gender (Male = 1, Female = 2),
- Preferred type of drink (1 = coffee, 2 = tea, 3 = milk, 4 = coke, 5 = juice),
- Mean monthly income (to the nearest 100 dollar),
- Mean daily expenditure on food (to the nearest dollar),
- Concern about the amount they spend (0 = not worried, 4 = extremely worried).

The results of the survey are given in the table below.

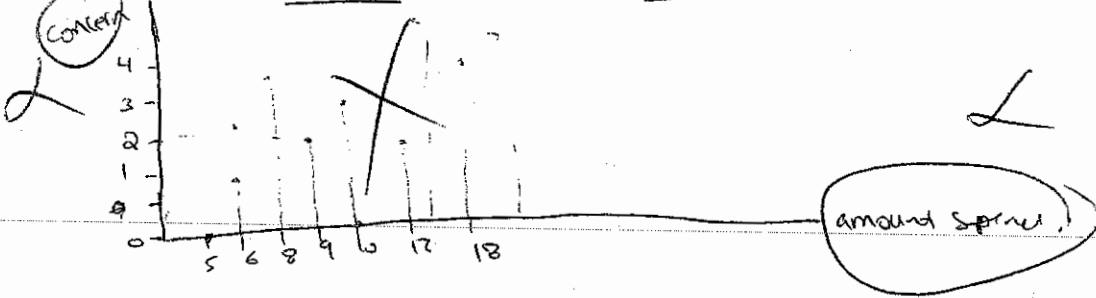
Gender	Preference	Income(x)	Expenditure(y)	Concern
1	2	7	10	3
1	1	5	6	1
1	3	9	9	2
1	4	8	10	0
1	4	10	12	2
2	2	12	18	4
2	2	7	8	4
2	2	6	5	0

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1. Is the data above referred to a sample or to a population? Sample
2. How many observations does this data set contain? Eight
3. Classify the variables in the survey as quantitative or qualitative. Determine the scale of measurements for each variable.

Variable	Type of data	Scale of measurement
Gender	Qualitative	nominal.
Preference	Qualitative	nominal.
Income	Quantitative	ratio
Expenditure	Quantitative	ratio
Concern	Qualitative	ordinal.

4. Construct a bar graph for the variable "concern".



5. Are there any outliers for the variable "expenditure"? Support your answer.

① order 5, 6, 8, 9, 10, 12, 18

③ IQR = 11 - 7 = 4 * 1.5 = 6

② smallest, Q_1 , Q_2 , Q_3 , largest
 5 7 9.5 11 18

$Q_1 - 1.5IQR$, $Q_3 + 1.5IQR$
 7 - 6, 11 + 6

$Q_1 = P_{25} = \frac{25}{100} * 8 = 2.5 \rightarrow \frac{6 + 8}{2} = 7$

(1, 17)

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$Q_2 = P_{50} \Rightarrow \frac{50}{100} * 8 = 4.5 \Rightarrow \frac{9 + 10}{2} = 9.5$

$Q_3 = P_{75} = \frac{75}{100} * 8 = 6.7 \Rightarrow \frac{10 + 12}{2} = 11$

18 is outlier because it's more than 17 which is the first.

Q#3(8 points)

The following table gives information on the monthly incomes (in hundreds of dollars) and monthly telephone bills (in dollars) for a random sample of ten Palestinian households.

Income(x)	Phone bill(y)	$x - \bar{x}$	$y - \bar{y}$	$(x - \bar{x})(y - \bar{y})$	$(x - \bar{x})^2$	$(y - \bar{y})^2$
10	25	-4	2	-8	16	4
14	27	0	4	0	0	16
7	15	-4	-8	32	16	64
9	22	-2	-1	2	4	1
11	21	0	-2	0	0	4
13	24	2	1	2	4	1
6	10	-5	-3	15	25	9
15	31	4	8	32	16	64
8	20	-3	-3	9	9	9
17	35	6	12	72	36	144

Hint: $\sum x = 110$, $\sum x^2 = 1330$, $\sum y = 230$, $\sum y^2 = 5766$

224 120 476

13. Do you expect these two variables to be linearly positively or negatively related? Support your answer.

$$s_{xy} = \frac{\sum (x - \bar{x})(y - \bar{y})}{n-1} = \frac{224}{9} = 24.8$$

$$\bar{x} = \frac{\sum x}{n} = \frac{110}{10} = 11$$

$$\bar{y} = \frac{\sum y}{n} = \frac{230}{10} = 23$$

$0 < s_{xy}$
positive relationship.
 $x - \bar{x}$ and $y - \bar{y}$ move in the same way.

✓

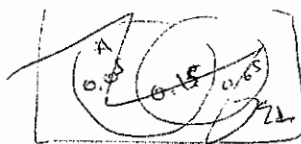
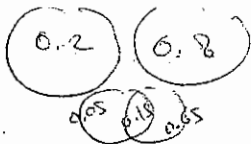
14. Compute the correlation coefficient. What does this value tell us about the relationship between the two variables?

$$r = \frac{s_{xy}}{s_x s_y} = \frac{24.8}{3.6 * 7.2} = \frac{24.8}{25.92} = 0.94$$

positive and strong
Because is it close to the one.

$$s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{120}{9}} = 3.6$$

$$s_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}} = \sqrt{\frac{476}{9}} = \sqrt{52.8} = 7.2$$



$$A + B = 1$$

$$0.2 + 0.8 = 1$$

Q# 4(8 points)

Assume you have applied for two scholarships, scholarship (A) and scholarship (B). The probability that you receive scholarship A is 0.2. The probability of receiving both scholarships is 0.15. The probability of getting at least one of the scholarships is 0.5.

$P(A \cap B)$

$P(A \cap B) = 0.15$

$$P(A) + P(B) - P(A \cap B) = 0.5$$

15. What is the probability that you will receive one scholarship only?

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

$$1 - 0.5 = P(A \cap B)$$

$$0.5 = P(A \cup B)$$

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

$$0.5 = 0.2 + 0.8 - 0.15$$

$$P(B) = 0.45$$

$$P(A \cup B) = 1 - P(A \cap B)$$

$$= 1 - 0.5$$

$$= 0.5$$

16. What is the probability that you will not receive any of the two scholarships? $P(A' \cap B')$

$$P(A' \cap B') = P?$$

$$1 - P(A \cup B) = 0.5$$

$$1 - 0.5 = P(A' \cap B')$$

$$0.5 = P(A' \cap B')$$

$$P(A \cup B) = 0.5$$

17. Are the two events A, and B, independent? Explain, using probabilities.

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

$$0.15 = 0.2 \cdot 0.45$$

$$0.15 \neq 0.09 \Rightarrow \text{Dependent (2)}$$

18. What is the probability of receiving the B scholarship given that you have been awarded the A scholarship?

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.15}{0.2} = 0.75$$

$$P(\text{not least}) \Rightarrow 1 - P(A' \cap B') = 0.5$$

$$1 - 0.5 = P(A \cup B)$$

$$0.5 = P(A \cup B) \Rightarrow 0.5 = P(A \cup B)$$

$$(2)$$

$$0.5 = P(A \cup B)$$

$$P(A \cup B) = 1 - P(A' \cap B')$$

$$P(A \cup B) = 1 - 0.5$$

(15)

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