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Gulf University for Science and Technology
College of Arts and Sciences

Basic Probability and Statistics

Final Examination – Fall 2013

Course Code: MATH 121

Section:

Instructor:
(Please circle your instructor's name)

Date: January 4th, 2014

Mohamed Ben-Romdhane	Maya Mitkova	Wassim Daher	Helmi Temimi
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Student Name: _____

Student Number: _____

Aids Allowed You can use a calculator, but it cannot be shared.

Instructions:

1. There are 2 tables for Normal distribution.
2. Formulas and tables are provided as separate.

This examination has a cover page, 10 pages with 11 questions. In addition, 3 pages for formula sheets and 2 pages for tables are provided. Before you start the examination please verify them.

No Questions are allowed during the examination

Student signature: _____

Objective	1	2		3		4	5		6		7	Total
Question	1	2	3	4	5	6	7	8	9	10	11	
Score per question												
Score per objective												
Out of	11	16		19		6	18		20		10	100

1. Final exam scores of 40 Math 121 students are summarized below.

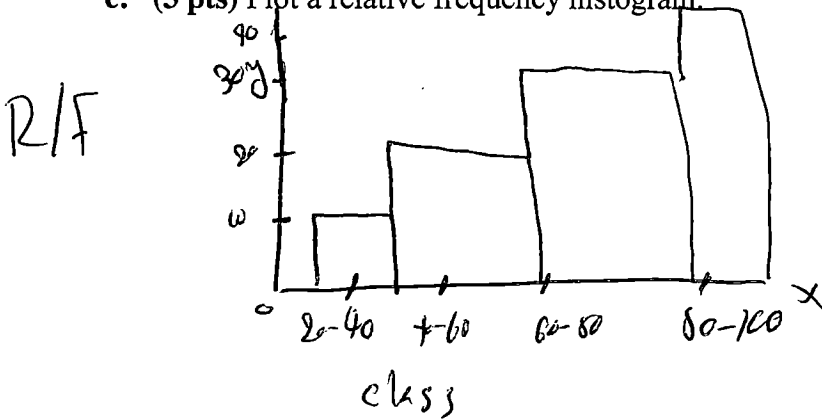
Age Classes	Frequency	Relative Frequency	Cumulative Frequency
20 but less than 40	4	0.1	10
40 but less than 60	8	0.2	20
60 but less than 80	12	0.3	60
80 but less than 100	16	0.4	100
Total	40		

a. (2 pts) Fill in the table.

b. (2 pts) What percent of the students scored less than 60?

30%

c. (3 pts) Plot a relative frequency histogram.



d. (4 pts) Find the midpoint of each class and use them to find the approximate mean of age.

class	frequency	midpoint
20-40	4	100 30
40-60		50

2. Number of students in 8 sections of Math 130 is given as follows

~~22, 27, 34, 30, 26, 23, 29, 14~~

14, 22, 23, 26, 27, 29, 30, 34

a) (4 pts) Find Q_1 , Q_2 , Q_3 , and IQR.

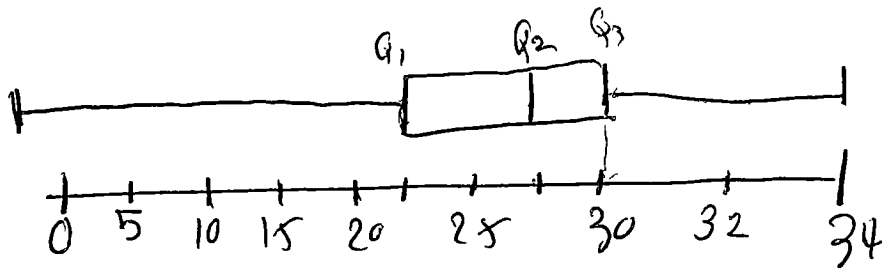
$$Q_1 = \frac{n+1}{4} = \frac{8+1}{4} = \frac{9}{4} \approx 2.25 \approx 2 = Q_1 = \boxed{22}$$

$$Q_2 = \frac{n+1}{2} = \frac{8+1}{2} = \frac{9}{2} = 4.5 = Q_2 = \frac{26+27}{2} = \boxed{26.5}$$

$$Q_3 = \frac{3(n+1)}{4} = \frac{3(8+1)}{4} = \frac{3(9)}{4} = \frac{27}{4} = 6.75 \approx 7 = Q_3 = \boxed{30}$$

$$\text{IQR} = Q_3 - Q_1 = 30 - 22 = \boxed{8}$$

b) (2 pts) Draw box-plot.

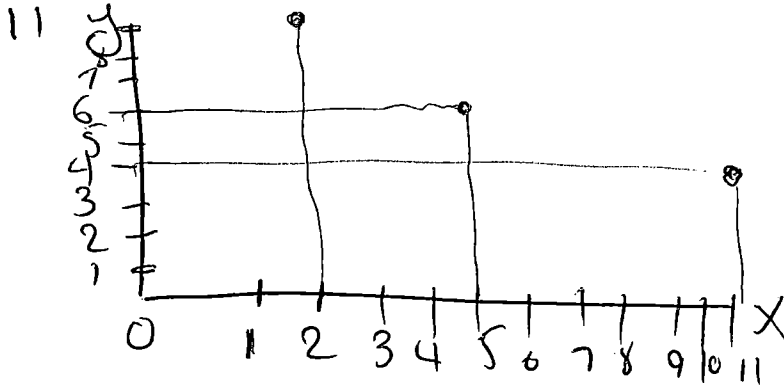


c) (2 pts) Comment on the distribution of the data based on your answer in part b).

3. In the following table, X represents the number of rainy days in winter and Y represents the number of sand storms during the year.

X	2	5	11
Y	11	6	4

a) (2 pts) Construct a scatter plot.



b) (3 pts) Find the covariance between X and Y and comment on your result.

$\bar{X} : 6$
 $\bar{Y} : 7$

$$Cov = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{n - 1}$$

x_i	$x_i - \bar{x}$	y_i	$y_i - \bar{y}$	$(x_i - \bar{x})(y_i - \bar{y})$
2	-4	11	4	-16
5	-1	6	-1	1
11	5	4	-3	-15

$$-\frac{30}{2} = \boxed{-15}$$

c) (3 pts) Find the correlation between X and Y and comment on your result.

$$\text{Correlation} = \frac{Cov(x, y)}{S_x \cdot S_y}$$

$$S_x$$

$x_i - \bar{x}$	x_i^2	Total
-4	16	42
-1	1	
5	25	

$$S_y$$

$y_i - \bar{y}$	y_i^2	Total
4	16	26
-1	1	
-3	9	

$\frac{26}{2} = 13$

$$\frac{-15}{21 \cdot 13} = \boxed{-0.054}$$

weak negative

4. According to a survey conducted among masters students, the following table is observed for the degree they completed.

		Degree			
		Business	Science	Engineering	Total
Female	80	80	110	110	250
Male	30	30	70	160	150
Total	110	110	130	160	400

- a. (2 pts) What is the probability that a randomly selected student has a Business degree?

$$\frac{80}{400}$$

$$\frac{110}{400}$$

$$\frac{110}{400}$$

- b. (3 pts) What is the probability that a randomly selected student is a male and has a science degree?

$$\frac{70}{400}$$

$$\frac{70}{400}$$

$$\frac{70}{150 + 60} = \frac{70}{210}$$

- c. (3 pts) What is the probability that a randomly selected student is a female or has an engineering degree?

$$\frac{250 + 50}{400}$$

$$\frac{110}{400}$$

$$\frac{250 + 50}{400}$$

$$\frac{250 - 110 + 160}{400}$$

- d. (3 pts) If you randomly select a student who has a science degree, what is the probability that the student is a male

$$\frac{60}{250}$$

$$\frac{150}{130}$$

5. (8 pts) Suppose that $P(A \cup B) = 0.80$, $P(A) = 0.45$ and $P(B) = 0.70$.

a. Find $P(A \cap B)$.

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

$$0.80 = 0.45 + 0.70 - P(A \cap B)$$

$$P(A \cap B) = 0.45 + 0.70 - 0.80 = 1.15 - 0.80 = \underline{\underline{0.35}}$$

b. Find $P(A|B)$.

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.35}{0.70} = 0.5$$

6. (6 pts) In how many different ways can we select 2 instructors and 3 teaching assistants for a proctoring from 5 instructors and 7 teaching assistants?

$${}^5C_2 \cdot {}^7C_3 = 10 \times 35 = 350$$

7. According to a survey, 30 % of the graduates of a university apply to an MBA program. A random sample of 11 graduates is selected. (Hint: Binomial Distribution)

a. (3 pts) What is the probability that exactly four graduates apply to an MBA program?

b. (3 pts) What is the probability at least two graduates apply to an MBA program?

$$P(X \geq 2) = 1 - (P(X=0) + P(X=1))$$

c. (3 pts) What is the probability that 6 graduates **do not** apply to an MBA program?

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8. It is shown that the number of online visa applications in an embassy has a Poisson distribution. Moreover, the average number of visa applications is 3 per hour.

a. (3 pts) Find the probability of no visa applications during a randomly selected hour?

b. (3 pts) Find the probability of less than two visa applications during a randomly selected hour?

$$P(X < 2) = P(X=0) + P(X=1)$$

c. (3 pts) Find the probability of 13 visa applications in four hours?

9. Suppose that the salary increase of an employee in a company has a **normal** distribution with a mean of 120 KD and a standard deviation of 40 KD. An employee is randomly selected.

a. (3 pts) What is the probability that the increase is more than 90 KD for the employee?

b. (3 pts) What is the probability that the increase is between 80 KD and 130 KD for the employee?

c. (4 pts) Denote the salary increase with X . Find a such that $P(X < a) = 0.2358$?

10. The temperature in a city during the month of March is **uniformly** distributed between 10 and 18 degrees. We randomly select a day and consider the temperature.

a. (2 pts) Write and graph the probability density function.

b. (3 pts) What is the probability that the temperature will be between 8 and 12 degrees?

c. (3 pts) What is the probability that the temperature is less than 16 degrees?

d. (2 pts) Calculate the expected value and standard deviation of temperature.

11. It is observed that the weight of a chicken egg has a **normal** distribution with a mean of 60 grams and a variance of 25. A random sample of 16 eggs is selected.

a. (5 pts) What is the probability that the sample mean weight of eggs is more than 57 grams?

b. (5 pts) What is the probability that the sample mean weight of eggs is between 58 and 63 grams?