

# THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

*A Committee of the Council of ICPAU*

## CPA (U) EXAMINATIONS

### LEVEL ONE

#### QUANTITATIVE TECHNIQUES - PAPER 5

**WEDNESDAY, 18 JUNE 2008**

#### INSTRUCTIONS TO CANDIDATES

1. Time allowed: **3 hours**
2. Attempt **three** questions in Section **A** and **two** questions in Section **B**
3. Section A has **four** questions and only **three** are to be attempted. Each question carries 20 marks.
4. Section B has **three** questions and only **two** are to be attempted. Each question carries 20 marks
5. Please read further instructions on the answer booklet.

**SECTION A****Question 1**

- (a) Distinguish between sample and population. **(4 marks)**
- (b) In order to find out whether entrepreneurs who start new companies generally do so when they are young or when they are middle aged and have become tired of working for someone else, a survey was carried out and the following data obtained:

<b>Age of entrepreneur (years)</b>	<b>Percentage</b>
20 – 25	9
25 – 30	17
30 – 35	21
35 – 40	18
40 – 45	15
45 – 50	9
50 – 55	11

**Required:**

- (i) Compute the mean and median age at which people start new businesses. **(10 marks)**
- (ii) Explain why the mean value is bigger than the median value. **(2 marks)**
- (iii) Represent the above data on a histogram. **(4 marks)**

**(Total 20 marks)****Question 2**

- (a) An instructor wishes to estimate the mean performance of his students in a statistics class. He selects a random sample of 100 students, administers a test and obtains mean,  $\bar{x} = 15.5$  and standard deviation,  $s = 5$ .

**Required:**

Construct the 90% confidence interval for the mean performance of the students.

- (6 marks)**
- (b) A woman wrote to "ASK THE DOCTOR" saying that she had been pregnant for 310 days before giving birth. Completed pregnancies are normally distributed with a mean of 266 days and a standard deviation of 16 days.

**Required:**

Find the probability that a pregnancy lasts longer than:

- (i) 270 days (2 marks)
- (ii) 300 days (2 marks)
- (c) The time taken by the milkman to deliver milk to town is normally distributed with mean of 12 minutes and standard deviation of 2 minutes. He delivers milk everyday.

**Required:**

Determine the number of days during the year (365 days) when he takes

- (i) Longer than 17 minutes. (3 marks)
- (ii) Less than 10 minutes. (3 marks)
- (iii) Between 9 and 13 minutes. (4 marks)

**(Total 20 marks)**

**Question 3**

- (a) Distinguish between type I and type II errors. (2 marks)
- (b) Explain the terms 'utility' and 'marginal cost'. (4 marks)
- (c) A firm has the following average revenue function (demand curve):

$$P = 100 - 0.01Q.$$

where Q is weekly production and P is price, measured in shillings per unit.

The firm's cost function is given by  $C = 50Q + 30,000$ .

Assume the firm maximizes profits.

**Required:**

- (i) Determine the equilibrium level of production Q, price P and profits per week. (8 marks)
- (ii) The government decides to levy a tax of Shs 10 per unit on the production. Determine the new level of production, the price and the profit, as the result of the tax.

**(6 marks)**

**(Total 20 marks)**

**Question 4**

- (a) Explain the term “decision rule”.  
(2 marks)
- (b) Distinguish between unbiased estimator and efficient estimator.  
(4 marks)
- (c) The results below were obtained in a small-scale experiment to study the relationship between storage temperature (in °F) (X) and the number of weeks before flavour deterioration of a food product (Y) begins to occur.

Predictor	Coefficient	Standard deviation	t-ratio	P
Constant	1140.1	95.18	11.98	0.000
X	-12.629	6.289	-2.01	0.066
S = 168.2		$R^2 = 0.237$	$R^2(\text{adj.}) = 0.178$	

**Analysis of Variance**

Source	DF	SS	MS	P
Regression	1	114158	114158	0.066
Error	13	367975	28306	
Total	14	482133		

**Required:**

- (i) State the least squares line.  
(1 mark)
- (ii) Interpret the meaning of each of the predictions.  
(4 marks)
- (iii) Determine the proportion of the variation in Y explained by the regression line.  
(1 mark)
- (iv) Compute the F-value.  
(2 marks)
- (v) State the p-value for testing the null hypothesis that the slope of the regression line is zero.  
(1 marks)
- (vi) Construct the 95% confidence interval for the slope of the regression line.

(5 marks)  
(Total 20 marks)

**SECTION B****Question 5**

- (a) The students of a Quantitative Techniques course want to buy a gift for their instructor. If each member of the class contributes 6 dollars towards the purchase of the gift, they will still be short by 16 dollars. On the other hand if each member contributes 9 dollars, they will have a surplus of 11 dollars, after the purchase of the gift.

**Required:**

- (i) Find the number of the students in the class.

**(3 marks)**

- (ii) Find the cost of the gift.

**(2 marks)**

- (b) A bicycle factory is to be built. There are two types of assembly lines which can be used for assembling the bicycles. An assembly line of type A can produce 5 bicycles per day. It occupies  $500\text{m}^2$  of floor space and needs 9 skilled workmen to operate. An assembly line of type B can produce 3 bicycles per day. It occupies  $600\text{m}^2$  of floor space but needs only 4 skilled men to operate. In the factory there is  $6000\text{m}^2$  of floor space available for assembly lines. Only 72 skilled workmen are available.

**Required:**

- (i) Write the maximization problem.

**(1 mark)**

- (ii) Determine all the constraints.

**(4 marks)**

- (iii) Use the graphical method to determine how many of each type of lines the factory manager should install.

**(7 marks)**

- (iv) Find the maximum possible number of bicycles to be produced in a day.

**(1 mark)**

- (v) Find the maximum value of output for the day if each bicycle costs Shs 130,000.

**(2 marks)****(Total 20 marks)**

**Question 6**

- (a) The job performance of ten employees was ranked by two supervisors familiar with their work as follows:

Supervisor	EMPLOYEE									
	A	B	C	D	E	F	G	H	I	J
1	5	6	3	9	4	8	1	7	10	2
2	3	4	1	8	5	10	6	7	9	2

**Required:**

- (i) Compute Spearman's rank correlation measure of the two sets of ratings.  
(5 marks)
- (ii) Is it significantly greater than 0 at the 2.5% level?  
(5 marks)
- (b) The sales of a leasing company have a trend line that is represented by the equation  $Y = 55,000 + 1250t$ , where  $t = 1$  is the first quarter of 1967. The four quarterly seasonal indices of sales are 107, 100, 82 and 111.

**Required:**

- (i) Approximate how sales have been increasing each quarter in the past.  
(1 mark)
- (ii) Approximate the level of sales in the first quarter of 1967.  
(3 marks)
- (iii) Forecast quarterly sales for the year 1999.  
(6 marks)
- (Total 20 marks)**

**Question 7**

- (a) The number of bids submitted by a Certified Public Accounting firm prior to winning a competitive government contract from the Small-scale Business Administration in Uganda is given in the following distribution:

X	1	2	3	4	5
P(X = x)	0.1	0.2	0.4	0.2	0.1

**Required:**

Find the:

- (i) Mean. (3 marks)
- (ii) Variance. (3 marks)
- (iii) Standard deviation. (1 mark)

- (b) A Japanese automobile manufacture currently produces its best selling U.S model in Japan, but the relative strength of the Japanese Yen versus the U.S dollar has been making the car very expensive for the U.S market. To ensure a lower and more stable price, the company is considering the possibility of manufacturing cars for U.S consumers at one of its American plants. Its payoff table, in millions of dollars, is given below:

Alternative	State of nature		
	Weak dollar Probability = 0.3	Moderate dollar Probability = 0.5	Strong dollar Probability = 0.2
Japanese production	10	15	25
American production	20	18	16

**Required:**

- (i) Make a decision tree summary of the table above. (2 marks)
  - (ii) Compute the expected payoff for each production. (2 marks)
  - (iii) Compute the expected payoff with perfect information. (1 mark)
  - (iv) Compute the expected value of perfect information. (1 mark)
- (c) A computer system consists of a key board, a monitor and the computer itself. The three parts are manufactured separately. From past experience, it is known that on delivery, the probability that the monitor works correctly is 0.99, the probability that the key board work correctly is 0.98 and the probability that the computer works correctly is 0.95.

**Required:**

Find the probability that the:

- (i) entire system works correctly. (2 marks)
  - (ii) exactly two of the components work correctly. (5 marks)
- (Total 20 marks)**