

THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

A Committee of the Council of ICPAU

CPA (U) EXAMINATIONS

LEVEL ONE

QUANTITATIVE TECHNIQUES - PAPER 5

FRIDAY, 10 DECEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Time allowed: **3 hours 15 minutes**.

The first 15 minutes of this examination have been designated for reading time. You may not start to write your answer during this time.

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. Formulae and tables are provided on pages 7 and 8.

6. Please read further instructions on the answer booklet, before attempting any question.

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SECTION A**Question 1**

- (a) Define the terms:
- (i) Mean deviation. **(2 marks)**
 - (ii) Standard deviation. **(2 marks)**
 -)
 - (ii) A semi quartile deviation. **(2 marks)**
 - i)
- (b) "The standard deviation is the 'natural partner' to the mean". Explain this statement. **(3 marks)**

- (c) Mpuma Ltd. made the following sales in the month of March 2010 by different salesmen in different localities.

Number of sales	0 - 6	7 - 12	14 - 20	21 - 27
Number of salesmen	2	6	8	13

Required:

Calculate the:

- (i) mean sales. **(3 marks)**
 - (ii) standard deviation. **(4 marks)**
 - (iii) coefficient of variation. **(2 marks)**
- (d) Give the importance of coefficient of variation in statistics. **(2 marks)**
- (Total 20 marks)**

Question 2

- (a) Using scatter diagrams, explain the term 'correlation'. **(3 marks)**
- (b) The following data shows the relationship between variables x and y:

x	8	10	9	4	9	11	12
y	30	42	32	18	30	43	45

- (i) Calculate the Spearman's rank correlation coefficient. **(6 marks)**
 - (ii) Interpret your result in (b) (i) above). **(2 marks)**
- (c) The following data shows the total cost (£) against output of items from a factory during the first five weeks:

Output (000) items (x)	3	15	9	24	5
Cost (£) (y)	26	49	19	67	27

Required:

- (i) Find the least squares regression line of y on x . **(7 marks)**
- (ii) Use the line in (c) (i) above to estimate the value of x when $y = 50$. **(2 marks)**

(Total 20 marks)

Question 3

- (a) Probability theory tries to predict the likelihood of a particular outcome occurring out of a large sample of events.

Required:

Explain the meaning of the above statement using different definitions.

(5 marks)

- (b) The time taken to deliver items of a particular type of goods from warehouse B to warehouse C is known to be normally distributed with a mean of 5 hours and standard deviation of 2 hours.

Required:

Calculate the probability that the time taken to deliver items randomly selected will take:

- (i) less than 6 hours. **(3 marks)**
- (ii) less than 3 hours. **(3 marks)**
-)
- (iii) between 3 and 6 hours. **(3 marks)**
-)

- (c) The demand for MAT Ltd's product is dependent on price. The price function is given by $P = 2x^2 - 135x + 2700$ where x is the quantity sold and revenue is in shillings.

Required:

- (i) Use differential calculus to find the sales volume at which revenue is maximized.
- (ii) Hence, find the maximum revenue.

(6 marks)

(Total 20 marks)

Question 4

- (a) Explain why 'index numbers' and 'time series' are called economic barometers. **(4 marks)**
- (b) What is an index number? **(2 marks)**
- (c) The prices of matooke and rice during January 2006 and January 2008 were as follows:

	2006		2008	
Item	Quantity (kg)	Price per unit Shs '000'	Quantity (kg)	Price per unit Shs '000'
Matooke	1000	2,000	1,500	3,000
Rice	3000	800	2,000	1,600
Beans	6000	400	8,000	200

Required:

- (i) Taking 2006 as the base year, calculate the price index in 2008 using:
- Las Peyre index. **(4 marks)**
 - Paasche index. **(4 marks)**
- (ii) Calculate quantity index using Paasche index. **(3 marks)**
- (iii) Give **three** limitations of index numbers. **(3 marks)**

(Total 20 marks)**SECTION B****Question 5**

- (a) Explain the term 'skeweness of a grouped frequency distribution'. **(3 marks)**
- (b) The cost of production at Nkuku's production department in January 2010 was as follows:

	Departments	
	A	B
Direct materials (Shs million)	0.8	1.2
Direct labour (Shs million)	0.6	0.9
Production overhead (Shs million)	1.6	0.6

Required:

- (i) Draw a percentage component bar chart for the data.
(5 marks)
- (ii) What are the **three** advantages of using the chart in (a) (i) above in presenting data?
(3 marks)
- (c) A company has an old machine which produces 40% of the total output but 20 units out of every 80 are defective. The company has purchased a new machine that produces 60% of the total output but 4 out of every 80 units are defective.
- Required:**
- (i) Draw a probability tree to represent this information.
(6 marks)
- (ii) Find the probability of a defective unit being got from the new machine.
(3 marks)
- (Total 20 marks)**

Question 6

- (a) (i) Define the term 'network analysis'.
(2 marks)
- (ii) Outline **four** major steps a systems analyst considers when designing computer programmes in network analysis.
(4 marks)
- (b) The following linear inequalities were provided by a cost accountant. They relate to constraints he met while planning for manufacturing products X and Y during February 2009.
- X and Y relate to number of units of type X and Y relates to number of units of type of Y.
- Labour constraints: $2x + y \leq 120$
 Material constraints: $x + 2y \leq 140$
 Testing: $1.5x + 2y \geq 120$
 Sales: $x \geq 20$
 Non-negativity: $y \geq 0, x \geq 0$
 The contribution function is $(12x + 9y)$.
- Required:**
- (i) Using the graphical method, find the production mix that maximizes contribution.
(7 marks)
- (ii) Find the maximum contribution.
(3 marks)

- (iii) State **four** limitations of the linear programming model.
(4 marks)
(Total 20 marks)

Question 7

- (a) When the price is Shs 110 the demand for a product in the accounting period is 30 units. If the price is reduced to Shs 50 the demand increases by 20 units.

Required:

Assuming linearity, find the relationship between price and demand.

(3 marks)

- (b) (i) State the **four** components of a time series?

(2 marks)

- (ii) Describe **four** factors that need to be considered when forecasting sales.

(4 marks)

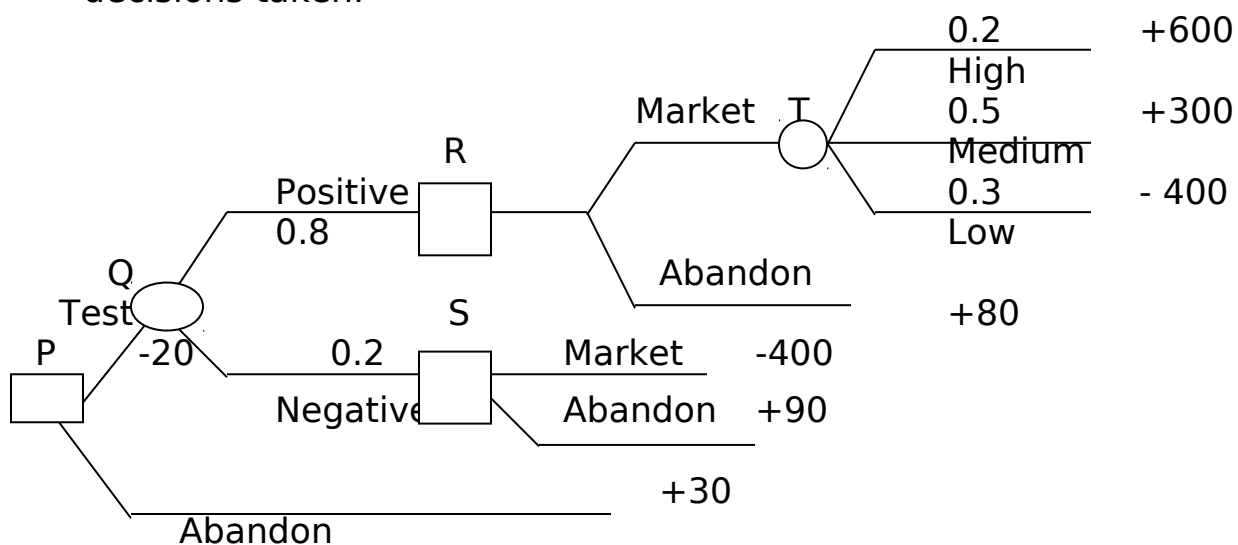
- (c)(i) Explain the term 'hypothesis testing'.

(2 marks)

- (ii) Describe the three steps followed in hypothesis testing.

(3 marks)

- (d) Nitia Ltd is introducing a new HIV vaccine which requires testing at a cost of Shs 20 million. The diagram below illustrates the decisions taken:

**Required:**

Study the decision tree and evaluate the expected values of each unit course and give your conclusion.

(6 marks)**(Total 20 marks)**

FORMULAE

1 Step deviation method $s = \sqrt{\frac{\sum fd^2}{N} - \left[\frac{\sum fd}{N} \right]^2} \times i$

Where $d = \frac{X - A}{i}$, and 'i' is the common factor

2 Coefficient of variation (C.V) $C.V = \frac{\sigma}{\bar{X}} \times 100$

3 Spearman's rank correlation coefficient $r_s = 1 - \frac{6\sum d^2}{n^3 - n}$

Where r_s = Spearman's Rank correlation Coefficient

n = Number of observations

d = the difference of ranks between paired items in the two series.

4 The formula to obtain b and a are:

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2}$$

$$a = \frac{\sum Y}{n} - b \frac{\sum X}{n}$$

Where X is the independent variable

Y is the dependent variable

n is the number of items in the sample.

5 Laspeyres price index $p = \frac{\sum p_t q_0}{\sum p_0 q_0} (100)$

6 Paasche price index $p = \frac{\sum p_t q_t}{\sum p_0 q_t} (100)$

7. Standard normal distribution $z = \frac{x - \mu}{\delta}$

NORMAL DISTRIBUTION N(0,1) $\phi(Z)$											SUBTRACT								
Z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.0	0.3989	3989	3989	3988	3986						0	1	1	1	1	2	2	2	3
0.1	0.3970	3965	3961	3956	3951	3984	3982	3980	3977	3973	0	1	1	2	2	3	3	4	4
0.2	0.3910	3902	3894	3885	3876	3945	3939	3932	3925	3918	1	1	2	3	3	4	5	6	6
0.3	0.3814	3802	3790	3778	3765	3867	3857	3847	3836	3825	1	2	3	4	4	5	6	7	8
0.4	0.3683	3668	3653	3637	3621	3752	3739	3725	3712	3697	1	2	3	4	5	6	7	8	10
0.5	0.3521	3503	3485	3467	3448	3605	3589	3572	3555	3538	1	3	4	5	6	7	8	10	11
0.6	0.3332	3312	3292	3271	3251	3429	3410	3391	3372	3352	2	3	5	6	8	10	11	13	14
0.7	0.3123	3101	3079	3056	3034	3230	3209	3187	3166	3144	2	4	6	7	9	10	13	15	17
0.8	0.2897	2874	2850	2827	2803	3011	2989	2966	2943	2920	2	5	7	8	10	13	15	17	19
0.9	0.2661	2637	2613	2589	2565	2780	2756	2732	2709	2685	2	5	7	10	12	14	16	18	21
1.0	0.2420	2396	2371	2347	2323	2516	2492	2468	2444	2420	2	5	7	10	12	14	16	18	21
1.1	0.2179	2155	2131	2107	2083	2299	2275	2251	2227	2203	2	5	7	10	12	14	16	18	21
1.2	0.1942	1919	1895	1872	1849	2059	2036	2012	1989	1965	2	5	7	9	11	14	16	18	21
1.3	0.1714	1691	1669	1647	1626	1826	1804	1781	1758	1736	2	4	7	9	11	13	15	18	20
1.4	0.1497	1476	1456	1435	1415	1582	1561	1539	1518	1497	2	4	6	8	10	12	14	16	18
1.5	0.1295	1276	1257	1238	1219	1394	1374	1354	1334	1315	2	4	6	8	9	11	13	15	17
1.6	0.1109	1092	1074	1057	1040	1200	1182	1163	1145	1127	2	3	5	7	8	10	12	14	15
1.7	0.0940	0925	0909	0893	0878	1006	0989	0973	0957	0940	2	3	5	6	8	9	11	12	14
1.8	0.0790	0775	0761	0748	0734	0863	0848	0833	0818	0804	1	3	4	6	7	8	10	11	13
1.9	0.0656	0644	0632	0620	0608	0721	0707	0694	0681	0669	1	3	4	5	7	8	9	10	12
2.0	0.0540	0529	0519	0508	0498	0596	0584	0573	0562	0551	1	2	4	5	6	7	8	10	11
2.1	0.0440	0431	0422	0413	0404	0488	0478	0468	0459	0449	1	2	3	4	5	6	7	8	9
2.2	0.0355	0347	0339	0332	0325	0396	0387	0379	0371	0363	1	2	3	4	4	5	6	7	8
2.3	0.0283	0277	0270	0264	0258	0317	0310	0303	0297	0290	1	1	2	3	4	4	5	6	6
2.4	0.0224	0219	0213	0208	0203	0252	0246	0241	0235	0229	1	1	2	2	3	4	4	5	5
2.5	0.0175	0171	0167	0163	0158	0198	0194	0189	0184	0180	0	1	1	2	2	3	3	4	4
2.6	0.0136	0132	0129	0126	0122	0154	0151	0147	0143	0139	0	1	1	1	2	2	2	3	3
2.7	0.0104	0101	0099	0096	0093	0119	0116	0113	0110	0107	0	1	1	1	2	2	2	3	3
2.8	0.0079	0077	0075	0073	0071	0104	0100	0096	0093	0090	0	1	1	1	2	2	2	3	3
2.9	0.0060	0058	0056	0055	0053	0099	0096	0093	0090	0087									
3.0	0.0044	0033	0024	0017	0012	0084	0080	0076	0073	0070	1	2	3	4	5	6	7	8	9
						0009	0006	0004	0003	0002	1	1	2	2	3	4	4	5	5

The functions tabulated are:

$$\phi(Z) = \sqrt{\frac{1}{2\pi}} \exp\left(-\frac{1}{2}Z^2\right), \text{ where } \phi(Z) \text{ is the probability density of the standardized normal distribution } N(0,1)$$

CRITICAL POINTS OF THE NORMAL DISTRIBUTION Z_p

P	Q	z	P	Q	z	P	Q	z
.00	.50	0.000	.460	.040	1.751	.490	.010	2.326
.05	.45	0.126	.462	.038	1.774	.491	.009	2.366
.10	.40	0.253	.464	.036	1.799	.492	.008	2.409
.15	.35	0.385	.466	.034	1.825	.493	.007	2.457
.20	.30	0.524	.468	.032	1.852	.494	.006	2.512
.25	.25	0.674	.470	.030	1.881	.495	.005	2.576
.30	.20	0.842	.472	.028	1.911	.496	.004	2.652
.35	.15	1.036	.474	.026	1.943	.497	.003	2.748
.40	.10	1.282	.476	.024	1.977	.498	.002	2.878
.45	.05	1.645	.478	.022	2.014	.499	.001	3.090
.450	.050	1.645	.480	.020	2.054	.4995	.0005	3.291
.452	.048	1.665	.482	.018	2.097	.4999	.0001	3.719
.454	.046	1.685	.484	.016	2.144	.49995	.00005	3.891
.456	.044	1.706	.486	.014	2.197	.49999	.00001	4.265
.458	.042	1.728	.488	.012	2.257	.499995	.000005	4.417