

THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

A Committee of the Council of ICPAU

CPA (U) EXAMINATIONS

LEVEL ONE

QUANTITATIVE TECHNIQUES - PAPER 5

WEDNESDAY, 9 DECEMBER 2009

INSTRUCTIONS TO CANDIDATES

1. Time allowed: **3 hours15 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. Tables are given on page 8.
6. Please read further instructions on the answer booklet.

SECTION A**Question 1**

- (a) Briefly distinguish between the following terms:
- (i) Quantitative variable and qualitative variable. **(2 mark)**
 - (ii) Frequency distribution and frequency density distribution. **(2 marks)**
- (b) At ABX Xerox Company Ltd workers are paid per hour for continuous work. A survey of the earnings for the workers led to the following data (in thousands of shillings):
- All the earnings range from 40 - 55.
 - The median, lower and upper quartiles were 45, 43 and 52 respectively.
 - 10% of the workers earn under 42.
 - 13% of the workers earn above 52.
 - 6% of the workers earn above 53.

Required:

- (i) Interpret the data and construct a frequency density distribution table. **(9 marks)**
 - (ii) Calculate the mean. **(3 marks)**
- (c) A random sample of 50 mathematics grades out of a total of 200 grades, gave a normal distribution with a mean of 75 and standard deviation of 10.

Required:

Determine the 95% confidence limits for the estimates of the mean.

(4 marks)

(Total 20 marks)

Question 2

- (a) With aid of graphs, briefly explain the following terms:
- (i) Skewness. **(2 marks)**
 - (ii) Kurtosis. **(2 marks)**
- (b) In order to establish the reading habits of CPA(U) students, a sample of 50 students was selected and asked to name the newspapers they read regularly.
- The results obtained showed that 25 read The New Vision (N), 16 read The Daily Monitor (M), 14 read The Observer (O); 5 read both N and M, 4 read both M and O, and 6 read both N and O; and 2 read all the three.

Required:

Find the probability that a student selected in this sample reads:

- (i) at least one of the newspapers.
- (ii) only one of the newspapers.
- (iii) only The New Vision.

(10 marks)

- (c) An author of a text book, Quantitative techniques, intends to sell the first set of books at Shs 60,000 per copy. The following table shows the prices and probabilities at which bookshops A and B are willing to sell the book.

	Bookshop A	Bookshop B
Price (Shs)	Probability	Probability
50,000	0.3	0.1
55,000	0.4	0.2
65,000	0.2	0.4
80,000	0.1	0.3

Required:

- (i) Calculate the expected sale price in each bookshop.
- (ii) Which bookshop would you recommend to sell the books, and why?

(6 marks)**(Total 20 marks)****Question 3**

- (a) The following table shows the amount of wheat (in thousands of metric tonnes) in different years:

Year 1	Amount	Year	Amount
1	390	9	435
2	381	10	474
3	372	11	459
4	405	12	438
5	420	13	435
6	396	14	492
7	387	15	510
8	381		

Required:

Determine, with a reason, the period of the moving average and hence calculate the moving average for that period.

(6 marks)

- (b) The sales manager of a large company conducted a survey in towns A & B, taking a sample 400 sales in each case.

The following results were obtained:

	Town A	Town B
Average sales (Shs '000')	2,500	2,200
Standard deviation	400	50

Required:

Test whether the average sales for the two towns are the same at 1% level of significance.

You may use the formula $z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$

(8 marks)

- (c) A textile worker in Azimio District earns Shs 750 per hour. The cost of living index calculated on an hourly basis in January 2000, was 160. Given the cost of living is based on the following data:

Group	Expenditure	Group index
Food	x	190
Clothing	125	181
Rent	y	140
Transport	100	118
Miscellaneous	75	101

Required:

Calculate the amount spent on food and the amount spent on rent.

(6 marks)

(Total 20 marks)

Question 4

- (a) The output equation of a local firm is given by the function:
 $N = 2q^3 + 3q^2 - 12q$, where q are units produced at any time in the firm.

Required:

Determine the extreme (maximum and minimum) values of the output.

(8 marks)

- (b) The Cricket Control Board wishes to promote cricket at village level at a minimal fee.

If the average cost for a ticket is Shs 50 per match 50,000 spectators will turn up and for an increase of Shs 5 per ticket, they would lose 5,000 spectators.

On average, each spectator spends Shs 4 in buying a souvenir which is also an income for the Cricket Control Board. The board also has to issue complementary gate passes and has to spend Shs 17,000 in making arrangements.

Required:

- (i) Calculate the cost of a ticket so as to maximize profit for the board.
(10 marks)
- (ii) Determine the maximum number of spectators that would be expected.

(2 marks)

(Total 20 marks)

SECTION B

Question 5

- (a) Briefly distinguish between the terms: 'line of best fit' and 'line of regression'.
(2 marks)
- (b) Peak Talk Telephone Company Ltd has increased the number of its retail shops. This has led to increased sales as indicated in the following table.

Number of retail shops (x)	Sales (Shs billion) (y)
900	0.75
1000	0.90
1100	0.95
1300	1.05
1350	1.20

Given that $y = mx + b$ gives the line of best fit, $m = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ and

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

where r is the coefficient of correlation.

Required:

- (i) determine the values of m and b and hence find the equation of the line of best fit.

(11 marks)

- (ii) if Peak Talk Telephone Company Ltd opens 50 more new retail shops, estimate the total sales. (3 marks)
- (iii) determine the value of r and interpret the results. (4 marks)

(Total 20 marks)**Question 6**

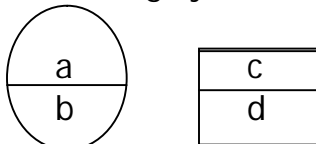
- (a) In linear programming problems:
- (i) State one major reason why the unwanted region is usually shaded. (2 marks)
- (ii) Explain how you would distinguish the following inequalities graphically.
 $y > 2x - 1$ and $y \geq 2x - 1$. (2 marks)

- (b) Solve the following linear programming problem by simplex tableau method and interpret your results.

$$\begin{aligned} \text{Maximize } P &= 6x + 5y + 4z \\ \text{Subject to } 2x + y + z &\leq 180 \\ x + 3y + 2z &\leq 300 \\ 2x + y + 2z &\leq 240 \\ x \geq 0, y \geq 0, z &\geq 0 \end{aligned}$$

(16 marks)
(Total 20 marks)**Question 7**

- (a) Define the following terms as they apply in network analysis.
- (i) Dummy variables.
- (ii) Critical path (2 marks)
- (b) The following symbols are commonly used in networks.

**Required:**What do the variables a , b , c and d represent?**(4 marks)**

- (c) XYZ Ltd manufactures and sells motor vehicle pelts. The selling price of pelts is Shs 600,000 per unit and the estimated demand and variable costs with their associated probabilities are as follows.

Demand (units)	Probability	Variable cost per unit (Shs)	Probability
5000	0.3	3000	0.1
6000	0.6	3500	0.3
8000	0.1	4000	0.5
		4500	0.1

Variable costs are independent of volume of sales and fixed costs amount to Shs 5,000,000.

Required:

Calculate the expected profit.

14 marks)
(Total 20 marks)

CUMULATIVE NORMAL DISTRIBUTION $P(z)$											ADD								
Z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.0	0.0000	0040	0080	0120	0160	0199	0239	0279	0319	0359	4	8	12	16	20	24	28	32	36
0.1	0.0398	0438	0478	0517	0557	0596	0636	0675	0714	0753	4	8	12	16	20	24	28	32	36
0.2	0.0793	0832	0871	0910	0948	0987	1026	1064	1103	1141	4	8	12	15	19	22	27	31	35
0.3	0.1179	1217	1255	1293	1331	1368	1406	1443	1480	1517	4	8	11	15	19	22	26	30	34
0.4	0.1554	1591	1628	1664	1700	1736	1772	1808	1844	1879	4	7	11	14	18	22	25	29	32
0.5	0.1915	1950	1985	2019	2054	2088	2123	2157	2190	2224	3	7	10	14	17	21	24	27	31
0.6	0.2257	2291	2324	2357	2389	2422	2454	2486	2517	2549	3	6	10	13	16	19	23	26	29
0.7	0.2580	2611	2642	2673							3	6	9	12	15	19	22	25	28
					2704	2734	2764	2794	2823	2852	3	6	9	12	15	18	21	24	27
0.8	0.2881	2910	2939	2967	2995	3023					3	6	8	11	14	17	20	22	25
							3051	3078	3106	3133	3	5	8	11	13	16	19	22	24
0.9	0.3159	3186	3212	3238	3264	3289					3	5	8	10	13	16	18	21	23
							3315	3340	3365	3389	2	5	7	10	12	15	17	20	22
1.0	0.3413	3438	3461	3485	3508						2	5	7	10	12	14	17	19	22
						3531	3554	3577	3599	3621	2	4	7	9	11	13	15	18	20
1.1	0.3643	3665	3686	3708							2	4	6	8	11	13	15	17	19
					3729	3749	3770	3790	3810	3830	2	4	6	8	10	12	14	16	18
1.2	0.3849	3869	3888	3907	3925						2	4	6	8	10	11	13	15	17
						3944	3962	3980	3997	4015	2	4	5	7	9	11	13	14	16
1.3	0.4032	4049	4066	4082	4099	4115	4131	4147	4162	4177	2	3	5	6	8	10	11	13	14
1.4	0.4192	4207	4222	4236	4251	4265	4279	4292	4306	4319	1	3	4	6	7	8	10	11	13
1.5	0.4332	4345	4357	4370	4382	4394	4406	4418	4429	4441	1	2	4	5	6	7	8	10	11
1.6	0.4452	4463	4474	4484	4495	4505	4515	4525	4535	4545	1	2	3	4	5	6	7	8	9
1.7	0.4554	4564	4573	4582	4591	4599	4608	4616	4625	4633	1	2	3	3	4	5	6	7	8
1.8	0.4641	4649	4656	4664	4671	4678	4686	4693	4699	4706	1	1	2	3	4	4	5	6	6
1.9	0.4713	4719	4726	4732	4738	4744	4750	4756	4761	4767	1	1	2	2	3	4	4	5	5
2.0	0.4772	4778	4783	4788	4793	4798	4803	4808	4812	4817	0	1	1	2	2	3	3	4	4
2.1	0.4821	4826	4830	4834	4838	4842	4846	4850	4854	4857	0	1	1	2	2	2	3	3	4
2.2	0.4861	4864	4868	4871	4875	4878	4881	4884	4887	4890	0	1	1	1	2	2	2	3	3
2.3	0.4893	4896	4898	4901	4904	4906	4909	4911	4913	4916	0	0	1	1	1	2	2	2	2
2.4	0.4918	4920	4922	4925	4927	4929	4931	4932	4934	4936	0	0	1	1	1	1	1	2	2
2.5	0.4938	4940	4941	4943	4945	4946	4948	4949	4951	4952									
2.6	0.4953	4955	4956	4957	4959	4960	4961	4962	4963	4964									
2.7	0.4965	4966	4967	4968	4969	4970	4971	4972	4973	4974									
2.8	0.4974	4975	4976	4977	4977	4978	4979	4979	4980	4981									
2.9	0.4981	4982	4982	4983	4984	4984	4985	4985	4986	4986									
3.0	0.4987	4990	4993	4995	4997	4998	4998	4999	4999	5000									

The table gives $P(z) = \int_0^z \phi(z) dz$

If the random variable Z is distributed as the standard normal distribution $N(0,1)$ then:

1. $P(0 < Z < z_p) = P(\text{Shaded Area})$
2. $P(Z > z_p) = Q = \frac{1}{2} - P$
3. $P(Z > |z_p|) = 1 - 2P = 2Q$

