

THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

A Committee of the Council of ICPAU

CPA (U) EXAMINATIONS

LEVEL ONE

QUANTITATIVE TECHNIQUES - PAPER 5

THURSDAY, 29 NOVEMBER 2012

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. Section **A** has **four** questions and only **three** are to be attempted. Each question carries 20 marks.
3. Section **B** has **three** questions and only **two** are to be attempted. Each question carries 20 marks
4. Tables are provided on page 10 - 11.
5. Write your answer to each question on a fresh page in your answer booklet.
6. Please, read further instructions answer booklet, before attempting any question.

SECTION A

Attempt three of the four questions in this section.

Question 1

- (a) Give **three** examples of quartiles. **(3 marks)**
- (b) A bank wishes to study the amount of time t (sec) it takes to complete a withdrawal transaction from one of its automated teller machines (ATM). On a particular day, 10 withdrawal transactions were observed between 9 am and 10 am. The time required to complete each transaction is given below.

Transaction	Time(sec)	Transaction	Time(sec)
1	32	6	39
2	32	7	33
3	41	8	43
4	51	9	35
5	42	10	33

Required:

Compute the

- (i) sample mean. **(2 marks)**
- (ii) sample standard deviation. **(5 marks)**
- (iii) interval $[\bar{x} \pm s]$, and find the percentage of transaction times that actually fall in the interval. **(4 marks)**
- (c) A new soap cutting machine is set to cut off pieces from a long bar of soap. For various reasons, the machine at times cuts off a piece that is too long or too short. These unacceptable pieces are automatically dropped in a container, and the operator of the machine must count these defectives after every 100 bars of soap have been cut. The record after the first day of operation is:

Bars of soap cut	Number of defectives	Proportion of defectives
100	5	0.05
100	6	0.06
100	7	0.07
100	4	0.04
100	8	0.08

Required:

Compute the:

- (i) arithmetic mean proportion.
- (ii) upper and lower control limits.

(2 marks)**(4 marks)****(Total 20 marks)**

Hint: Arithmetic mean proportion (\bar{p}) = $\frac{\text{sum of proportion of defectives}}{\text{number of samples}}$

$$\text{Control limits} = \bar{p} \pm 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}, \text{ where } n = \text{is the size of each sample.}$$

Question 2

- (a) HK-Restaurant has Shs 100,000 available to prepare either tea or coffee in preparation for a function that takes place annually in the location. A decision must be made early for planning. However, the restaurant is unable to predict whether the day will be cold or hot. If tea is prepared and the day is not cold, the pay-off will be Shs 120,000, but if the weather is cold the pay-off will only be Shs 105,000. If coffee is prepared, the pay-offs for hot and cold weather are Shs 110,000 and Shs 125,000 respectively. Past records show that 70% of similar functions were hot and 30% were cold.

Required:

Determine the two expected pay-offs and arrive at the decision.

(7 marks)

- (b) KIDA Communications sells units of communication equipment to both the military and civilian markets. The following year's sales depend on market conditions that cannot be predicted exactly. The company follows the modern practice of using probability estimates of sales based on the informed opinion of the company's executive.

The military division estimates its sales as follows:

Units sold	1,000	3,000	5,000	10,000
Probability	0.1	0.3	0.4	0.2

The corresponding sales estimates for the civilian division are as follows:

Units sold	300	500	750
Probability	0.4	0.5	0.1

Taking x to be the number of military units and y to be the number of the civilian units, and that the company makes a profit of Shs 2,000 on each military unit and Shs 3,500 on each civilian unit, the following year's profit accrued is given by $Z = 2,000x + 3,500y$.

Required:

Compute the expected:

- (i) value for the military. (2 marks)
- (ii) value for civilian. (2 marks)
- (iii) profit. (2 marks)
- (c) BX-Systems Ltd has 800 employees. 20% of the employees have college degrees, half of whom are in non-management positions. 30% of the non-degree people are in management positions.

Required:

Find the:

- (i) number of managers in the company. (5 marks)
 - (ii) conditional probability that an employee is a graduate given that he/she is a manager. (2 marks)
- (Total 20 marks)**

Question 3

- (a) State **three** measures of central tendency. (3 marks)
- (b) A human resource director in QUICK Marketing Ltd has to interview and select new sales representatives. He has designed a test that he hopes will help him select the best possible applicants for the department. In order to check on the validity of the test as a predictor, he randomly chose five experienced sales representatives and administered the test to each one. The test score of each was then paired with his or her weekly sales as in the table below.

Sales representative	Test score	Weekly sales (Shs'000)
A	4	500
B	7	1,200
C	3	400
D	6	800
E	10	1,100

Required

(i) Compute the coefficient of correlation.

(6 marks)

(ii) Comment on the result in (b) (i) above.

(1 mark)

- (c) HDK fish processing factory operates from two branches. Records about its employees' absence from work due to sickness, over a two-month period were analyzed for each branch. The mean was 2.03 days per worker in branch A of a factory and 1.28 per worker in branch B. There were 65 workers in each of these branches. The estimates of the variances of the numbers of days' absence for branches A and B are 3.0125 and 2.1482 respectively.

Required:

Test whether the means in the two branches of the factory differ at 1% level of significance.

(7 marks)

- (d) The Institute of Certified Public Accountants of Uganda has a Council of 10 members from which they wish to form committees of 4 members each.

Required:

Find the number of ways in which the committees can be formed.

(3 marks)

(Total 20 marks)

Question 4

- (a) Distinguish between a constant and slack variable.

(2 marks)

- (b) A company producing two products X and Y has its objective and constraints summarized as: maximize
- $Z = 3x + 5y$
- subject to the restrictions:

$$x \leq 4$$

$$2y \leq 12$$

$$3x + 2y \leq 18 \text{ and}$$

$$x \geq 0, y \geq 0$$

Required:

Use the simplex tableau method to find the optimal solution.

(12 marks)

- (c) An index of clothing prices for 2010 based on 1999 is to be constructed. The prices and the quantities consumed respectively in 1999 and 2010 are shown in the table below:

Item	1999		2010	
	Price (Shs)	Units sold	Price (Shs)	Units sold
Dress (each)	10,000	300	25,000	500
Shoes (pair)	30,000	900	50,000	1,200

Required:

- (i) Construct the Paasche price index using 1999 as the base year.

(4 marks)

- (ii) Interpret your result in (c) (i).

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

Hint: Paasche price index = $\frac{\sum P_t q_t}{\sum P_o q_o} \times 100$

SECTION B

Attempt two of the three questions in this section

Question 5

- (a) State the **two** conditions that must be satisfied by a probability experiment.

(2 marks)

- (b) At Fresh Supplies grocery store, the quantity x , of mangoes sold daily changes with a change in the price, P such that at a price of Shs 2,000, 4 kg of mangoes are sold and when the price is Shs 1,400, 10 kg of mangoes are sold. The cost function, C is given by $600x$.

Required:

Find the:

- (i) price function. **(4 marks)**
 - (ii) sales function. **(1 mark)**
 - (iii) profit function. **(1 mark)**
 - (iv) quantity that will maximize the profit. **(3 marks)**
 - (v) maximum profit **(2 marks)**
- (c) EDEX management consultancy firm has installed a new computer wage billing system in Public Service. The mean time using the old billing system was approximately equal to 39 days. In order to assess whether the mean payment time, μ , using the new billing system is substantially less than 39 days, the consultancy firm will use the sample of $n = 65$ payment times to find a 95% confidence interval for μ . The mean and the standard deviation of the 65 payment times are $\bar{x} = 18.1077$ and $s = 3.9612$ respectively.

Required:

- (i) Calculate the 95% confidence interval for μ . **(5 marks)**
- (ii) Interpret the values. **(2 marks)**

(Total 20 marks)

Hint: Probability confidence interval $\left[\bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}} \right]$

Question 6

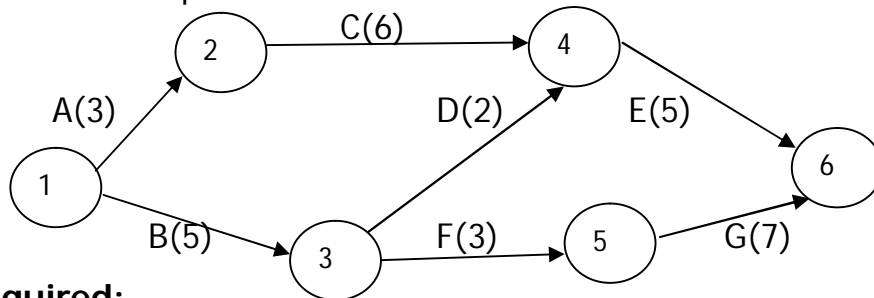
- (a) Distinguish between quasi-random sampling and quota sampling. **(2 marks)**
- (b) The scores in an Audit Theory exam have the probability distribution shown below:

x	60	70	80	90
P(x)	0.4	0.3	0.2	0.1

Required:

Calculate the:

- (i) expected score value. **(2 marks)**
- (ii) standard deviation. **(5 marks)**
- (c) A project has its activity network as shown below. The project activity paths and completion time in months are indicated on each arrow.

**Required:**

- (i) Identify all the paths from node 1 to node 6. **(3 marks)**
- (ii) Calculate the lengths of the paths based on the expected completion time. **(3 marks)**
- (iii) Find the minimum time in which the project should be completed. **(2 marks)**
- (iv) State the critical activities. **(3 marks)**

(Total 20 marks)

Question 7

- (a) The frequency distribution below shows households' monthly expenditure on food during a survey in Kampala:

Amount (Shs '000')	Frequency (Number of Households)
80 – 84	6
85 – 89	12
90 – 94	23
95 – 99	35
100 – 104	24
105 – 109	10

Required:

Compute the interquartile range of the food expenditure.

(6 marks)

- (b) The table below shows annual receipts from sales (million shillings) from timber by Wood Products Ltd over a period of time.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sales	8	11	9	14	9	10	10	8	12

Required:

- (i) Compute 3-year moving totals and 3 year moving averages for the data.

(4 marks)

- (ii) Plot the production data and the moving averages on a graph.

(5 marks)

- (iii) Use 2003 and 2009 to draw a straight line and find its equation.

(3 marks)

- (iv) Find the estimated production for 2013 based on the equation of the straight line in (b) (iii) above.

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

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	6	7	8	10	11	13
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	8	10	11	13	15	17
0.8	0.2897	2874	2850	2827	2803	3034	3011	2989	2966	2943	2	5	7	9	11	14	16	18	19
0.9	0.2661	2637	2613	2589	2565	2780	2756	2732	2709	2685	2	5	7	10	12	14	17	19	22
1.0	0.2420	2396	2371	2347	2323	2541	2516	2492	2468	2444	2	5	7	10	12	14	17	19	22
1.1	0.2179	2155	2131	2107	2083	2299	2275	2251	2227	2203	2	5	7	10	12	14	17	19	22
1.2	0.1942	1919	1895	1872	1849	2059	2036	2012	1989	1965	2	5	7	10	12	14	16	18	21
1.3	0.1714	1691	1669	1647	1626	1826	1804	1781	1758	1736	2	5	7	9	11	14	16	18	21
1.4	0.1497	1476	1456	1435	1415	1604	1582	1561	1539	1518	2	4	7	9	11	13	15	18	20
1.5	0.1295	1276	1257	1238	1219	1394	1374	1354	1334	1315	2	4	6	8	10	12	14	16	18
1.6	0.1109	1092	1074	1057	1040	1200	1182	1163	1145	1127	2	4	6	8	9	11	13	15	17
1.7	0.0940	0925	0909	0893	0878	1006	0989	0973	0957	0940	2	3	5	7	8	10	12	14	15
1.8	0.0790	0775	0761	0748	0734	0863	0848	0833	0818	0804	2	3	5	6	8	9	11	12	14
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	0246	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	0151	0147	0143	0139	0135	0	1	1	2	2	2	2	3	3
2.7	0.0104	0101	0099	0096	0093	0116	0113	0110	0107	0104	0	1	1	1	2	2	2	2	3
2.8	0.0079	0077	0075	0073	0071	0100	0097	0095	0093	0091	0	1	1	1	2	2	2	2	3
2.9	0.0060	0058	0056	0055	0053	0091	0088	0086	0084	0081	0	1	1	1	2	2	2	2	3
3.0	0.0044	0033	0024	0017	0012	0080	0077	0075	0073	0071	1	2	3	4	5	6	7	8	9
3.1						0060	0057	0055	0053	0051	1	1	2	2	3	4	4	5	5
3.2						0048	0046	0044	0042	0040									
3.3						0039	0037	0035	0033	0031									
3.4						0034	0032	0030	0028	0026									
3.5						0029	0027	0025	0023	0021									
3.6						0024	0022	0020	0018	0016									
3.7						0019	0017	0015	0013	0011									
3.8						0014	0012	0010	0008	0006									
3.9						0009	0007	0005	0003	0002									
4.0						0004	0003	0002	0001	0000									

The functions tabled 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

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. $P(Z > |z_p|) = 1 - 2P = 2Q$

