

# THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

*A Committee of the Council of ICPAU*

## CPA (U) EXAMINATIONS

### LEVEL ONE

### QUANTITATIVE TECHNIQUES - PAPER 5

**FRIDAY, 18 JUNE 2010**

#### 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 provided on pages 8 and 9.
6. Please read further instructions on the answer booklet.

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

- (a) Give **three** differences between dispersion and skewness. **(6 marks)**
- (b) The distribution of the number of hours put in by the workers in the production of instant coffee in a factory in Kigali is given in the table below:

Hours	Number of people
0 -	4
10 -	14
20 -	28
30 -	22
40 -	16
50 -70	16

**Required:**

- (i) Calculate the mean and mode of the hours of production in a week **(8 marks)**
- (ii) Calculate the skewness of the distribution, giving the answer to 3 significant figures. **(6 marks)**

**Hint:**  $Sk = \frac{\bar{x} - \text{mode}}{\delta}$

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

- (a) Distinguish between Laspeyre's and Paache's price indices. **(6 marks)**
- (b) Explain why weighting is used in the construction of index numbers. **(2 marks)**
- (c) The table below gives the output of a beverages company, in thousands of crates:

Month	Output	Month	Output
January	200	July	430
February	260	August	680
March	430	September	150
April	570	October	320
May	150	November	450
June	210	December	730

**Required:**

Find the five months' moving averages of the output and draw a graph for the data.

**(4 marks)**

- (d) A recent survey carried out by a researcher on the prices of various goods and services and the spending of an average person in Mbarara Town revealed the data indicated in the table below:

Item	Price relative	Weighting
Rent	103.4	25
Food	112.5	12
Clothing	111.2	11
Transport	115.3	6
Medical	100.6	8
Drinks	107.2	8
Telephone	100.8	3

**Required:**

- (i) Calculate the cost of living index in Mbarara Town, giving the answer to 1 decimal place.

**(6 marks)**

- (ii) Comment on the answer in (d) (i) above.

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

- (a) To obtain a mini statement (MS) and to use the Automatic Teller Machine (ATM), a customer of Stanbic Bank (U) Ltd (S) and Barclays Bank (U) Ltd (B) is charged user fees, in shillings, as shown below:

Bank	Charge on	
	MS	ATM
S	6,000	680
B	8,000	400

On a certain day, 15 and 12 customers respectively obtained mini statements from their banks and used the ATM.

**Required:**

Determine the amount of money collected by each bank from the above customers.

**(3 marks)**

- (b) The following summary of statistics were recorded from set a of data of the number of hours (x) a student was absent and the final score (y%) obtained in each subject:

$$n = 7, \sum x = 57, \sum y = 511, \sum x^2 = 579, \sum y^2 = 38,993, \sum xy = 3,745.$$

**Required:**

- (i) Determine the coefficient of correlation and comment on the relationship between hours absent and performance. **(3 marks)**

- (ii) Find the equation of regression for the data. **(5 marks)**

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

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

- (c) Omega Uganda Ltd assembles and sells television sets at Nalukolongo. The total cost (TC) and the total revenue (TR), in thousands of shillings, of assembling T television sets are given by the following functions:

$$TC = \frac{1}{2}T^3 - \frac{5}{2}T^2 + 50T + 500, \text{ and}$$

$$TR = 800T - 2T^3$$

**Required:**

Determine the:

- (i) profit function. **(3 marks)**

- (ii) number of television sets required to maximize profit. **(4 marks)**

- (iii) maximum profit. **(2 marks)**

**(Total 20 marks)**

**Question 4**

A retail shopkeeper at Kansanga has room for 20 crates of soda and 30 crates of beer. A supplier can supply the shopkeeper with a total of 36 crates on a certain day.

In a day, production work on each crate of soda takes 15 minutes and 10 minutes for a crate of beer. 7 hours are available for production work on crates in a day. The gross profit on each crate of soda and beer is Shs 3,000 and Shs 2,000 respectively.

Assume that  $x$  and  $y$  are the number of crates of soda and beer respectively stocked in a day and that the shopkeeper wishes to maximize profit.

**Required:**

- (a) Determine the objective function,  $z$  and state **four** constraints associated with  $z$ . **(5 marks)**
- (b) Draw a graph representing the feasible solution. **(10 marks)**
- (c) Given that the overhead costs of the shop on crates per day is Shs 60,000:
- (i) write down a constraint for the shop to operate profitably. **(2 marks)**
- (ii) shade the region in a feasible solution when the shop is making profits. **(3 marks)**
- (Total 20 marks)**

## SECTION B

### Question 5

- (a) In order to establish the competitiveness of Yellow Telecom, Purple Telecom and Red Telecom mobile telephone companies in the Ugandan market, a survey was conducted on a sample of customers selected from Kampala. The results generated were as follows: 190 were Yellow Telecom customers, 205 were for Purple Telecom and 260 for Red Telecom. 15 customers were for all the three networks, 55 were for Yellow Telecom and Red Telecom, 100 for Yellow Telecom only, 135 were for Red Telecom only. 180 of the people under study were not on any network.

**Required:**

Determine the:

- (i) size of the sample. **(5 marks)**
- (ii) probability that a customer is on Purple Telecom only. **(1 mark)**
- (iii) probability that a customer is on one network only. **(2 marks)**
- (iv) probability that a customer is on two networks only. **(2 marks)**
- (b) Mishi Publishers Ltd won a contract to publish copies of three business text books namely; Business Statistics (BS), Business Mathematics (BM) and Business Computing (BC). After one year in circulation, it was discovered that 3%, 5% and 4% of the BS, BM and BC text books respectively had mistakes. 40% of the copies published were for BS, 30% for BM and 30% for BC.

**Required:**

Find the probability that:

- (i) a text book published had mistakes. (4 marks)
  - (ii) the text book with a mistake was for BS and BC. (6 marks)
- (Total 20 marks)**

**Question 6**

- (a) (i) What is the student's t-distribution? (2 marks)
- (ii) Give **two** similarities between the student's t- distribution and the standard normal distribution. (2 marks)
- (iii) A sample of nine students of Quantitative Techniques who sat in the June 2008 session of ICPAU examinations obtained the following scores: 70, 63, 68, 71, 69, 64, 66, 65, 69.

**Required:**

Determine, at a 5% level of significance, and comment on ICPAU's assertion that the average score in that paper was 65; scores being normally distributed.

**(8 marks)**

- (b) Uganda Standards Bureau (USB), in a bid to check the importation of duplicate energy saving bulbs, carried out a study on the Phillips and Unilux bulbs. It was discovered that in a sample of 50 Phillips bulbs, the mean life time was 13,000 hours with a standard deviation of 1,200 hours. In a sample of 40 Unilux bulbs, the mean life was 12,000 hours with standard deviation of 1,000 hours. The life time of the bulbs is normally distributed.

**Required:**

Advise the USB's quality control department whether there is a significant difference in the life times of the two bulb brands at 5% level of significance.

**(8 marks)**

**(Total 20 marks)**

**Question 7**

A project to be implemented by a local NGO in a village in Karamoja consists of activities A to F inclusive with the following sequential relationship: A must follow C and E, B must follow A and F, D must follow B, F must follow C.

Activities C and E may take place at the same time and similarly activities A and F. The project manager has come up with the following implementation schedule:

Activity	Time (weeks)		Crash cost (\$ '000)
	Normal	Crash	
A	4	1	240
B	5	3	200
C	4	2	120
D	1	1	-
E	2	2	-
F	3	1	80

The benefactor of the project requires the project to be completed in 13 weeks.

A penalty of \$200,000 per week for excess time is imposed while a bonus of \$90,000 per week is granted for earlier completion.

**Required:**

- Draw a logical network based on normal durations for the project.  
(8 marks)
  - Determine the critical activities and the normal duration of the project.  
(3 marks)
  - Find the data which would enable one to plot the cost/time curve for the project.  
(6 marks)
  - Explain whether the normal duration should be changed and the effect it would cause.  
(3 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	5	6	7	8	10	11
0.6	0.3332	3312	3292	3271	3251	3725	3709	3692	3675	3657	2	3	4	5	6	7	8	10	11
0.7	0.3123	3101	3079	3056	3034	3752	3735	3717	3699	3681	2	4	5	6	7	8	9	11	12
0.8	0.2897	2874	2850	2827	2803	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
0.9	0.2661	2637	2613	2589	2565	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.0	0.2420	2396	2371	2347	2323	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.1	0.2179	2155	2131	2107	2083	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.2	0.1942	1919	1895	1872	1849	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.3	0.1714	1691	1669	1647	1626	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.4	0.1497	1476	1456	1435	1415	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.5	0.1295	1276	1257	1238	1219	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.6	0.1109	1092	1074	1057	1040	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.7	0.0940	0925	0909	0893	0878	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.8	0.0790	0775	0761	0748	0734	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
1.9	0.0656	0644	0632	0620	0608	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.0	0.0540	0529	0519	0508	0498	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.1	0.0440	0431	0422	0413	0404	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.2	0.0355	0347	0339	0332	0325	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.3	0.0283	0277	0270	0264	0258	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.4	0.0224	0219	0231	0208	0203	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.5	0.0175	0171	0167	0163	0158	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.6	0.0136	0132	0129	0126	0122	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.7	0.0104	0101	0099	0096	0093	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.8	0.0079	0077	0075	0073	0071	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
2.9	0.0060	0058	0056	0055	0053	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13
3.0	0.0044	0033	0024	0017	0012	3752	3735	3717	3699	3681	2	5	6	7	8	9	10	12	13

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



PERCENTAGE POINTS OF STUDENT'S  $t$ -DISTRIBUTION  $t_Q$ 

$\nu$	Probability*									$Q$	$2Q$
	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.050	0.01 0.02	0.005 0.010	0.0025 0.0050	0.001 0.002	0.0005 0.0010		
1	1.000	3.078	6.314	12.71	31.82	63.66	127.3	318.3	636.6		
2	0.816	1.886	2.920	4.303	6.965	9.925	14.09	22.33	31.60		
3	0.765	1.638	2.353	3.182	4.541	5.841	7.453	10.21	12.92		
4	0.741	1.533	2.132	2.776	3.747	4.604	5.598	7.173	8.610		
5	0.727	1.476	2.015	2.571	3.365	4.032	4.773	5.893	6.869		
6	0.718	1.440	1.943	2.447	3.143	3.707	4.317	5.208	5.959		
7	0.711	1.415	1.895	2.365	2.998	3.499	4.029	4.785	5.408		
8	0.706	1.397	1.860	2.306	2.896	3.355	3.833	4.501	5.041		
9	0.703	1.383	1.833	2.262	2.821	3.250	3.690	4.297	4.781		
10	0.700	1.372	1.812	2.228	2.764	3.169	3.581	4.144	4.587		
11	0.697	1.363	1.796	2.201	2.718	3.106	3.497	4.025	4.437		
12	0.695	1.356	1.782	2.179	2.681	3.055	3.428	3.930	4.318		
13	0.694	1.350	1.771	2.160	2.650	3.012	3.372	3.852	4.221		
14	0.692	1.345	1.761	2.145	2.624	2.977	3.326	3.787	4.140		
15	0.691	1.341	1.753	2.131	2.602	2.947	3.286	3.733	4.073		
16	0.690	1.337	1.746	2.120	2.583	2.921	3.252	3.686	4.015		
17	0.689	1.333	1.740	2.110	2.567	2.898	3.222	3.646	3.965		
18	0.688	1.330	1.734	2.101	2.552	2.878	3.197	3.610	3.922		
19	0.688	1.328	1.729	2.093	2.539	2.861	3.174	3.579	3.883		
20	0.687	1.325	1.725	2.086	2.528	2.845	3.153	3.552	3.850		
21	0.686	1.323	1.721	2.080	2.518	2.831	3.135	3.527	3.819		
22	0.686	1.321	1.717	2.074	2.508	2.819	3.119	3.505	3.792		
23	0.685	1.319	1.714	2.069	2.500	2.807	3.104	3.485	3.767		
24	0.685	1.318	1.711	2.064	2.492	2.797	3.091	3.467	3.745		
25	0.684	1.316	1.708	2.060	2.485	2.787	3.078	3.450	3.725		
26	0.684	1.315	1.706	2.056	2.479	2.779	3.067	3.435	3.707		
27	0.684	1.314	1.703	2.052	2.473	2.771	3.057	3.421	3.690		
28	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674		
29	0.683	1.311	1.699	2.045	2.462	2.756	3.038	3.396	3.659		
30	0.683	1.310	1.697	2.042	2.457	2.750	3.030	3.385	3.646		
40	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551		
60	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460		
120	0.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373		
$\infty$	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291		

The function tabulated is  $t_Q$  defined by

$$\int_{t_Q}^{\infty} f(t) dt = Q; \quad f(t) = \frac{(\frac{1}{2}\nu - \frac{1}{2})!}{\sqrt{(v\pi)(\frac{1}{2}\nu - 1)!}} \cdot \frac{1}{(1 + t^2/\nu)^{(\nu+1)/2}}$$

where  $f(t)$  is the probability density of the  $t$ -distribution.

Interpolation  $\nu$ -wise should be linear in  $120/\nu$  for  $\nu > 30$ .

Use (i) upper row for one tail-tests

(i) lower row for two tail-tests

If  $x$  is a random variable with the  $t$ -probability distribution for  $\nu$  degrees of freedom, the probability that  $x > t_Q$  is  $Q$  and the probability that  $|x| > t_Q$  is  $2Q$ .

The graph shows the form of the distribution for  $\nu = 2$ . The shaded area represents the probability  $Q$ . For large  $\nu$  the distribution approximates to the normal distribution  $N(0,1)$ , shown by the dotted line.

