

THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

A Committee of the Council of ICPAU

CPA (U) EXAMINATIONS

LEVEL ONE

QUANTITATIVE TECHNIQUES - PAPER 5

WEDNESDAY, 17 JUNE 2009

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. Please read further instructions on the answer booklet.

SECTION A**Question 1**

- (a) Distinguish between the following concepts as used in quantitative methods:

- (i) Primary data and secondary data.
- (ii) Pie chart and bar chart.
- (iii) Published data and unpublished data.

(6 marks)

- (b) Lakalacor Municipality has a total of 200 employees in four departments as follows: Social Services 100, Administration 30, Revenue Collection 50 and 20 in Law Enforcement. Furthermore, it is stated that 60 of the employees in Social Services are female, 5 female staff are in Law Enforcement, while Revenue Collection and Administration have 20 and 10 male employees respectively.

Required:

- (i) Construct a table representing the above data.

(4 marks)

- (ii) Construct subdivided bar chart representing the data.

(5 marks)

- (c) During the last 5 years, the Secretary of Concern Group of Companies kept records of attendance of meetings by Board members. The following table summarises the record of attendance for the 20 meetings held:

Members Present	11	12	13	14	15	16
Frequency	1	2	1	6	7	3

Required:

Calculate the:

- (i) mode. **(1 mark)**
- (ii) median. **(1 mark)**
- (iii) standard deviation. **(3 marks)**

(Total 20 marks)

Question 2

- (a) (i) Explain the distinction between permutation and combination. **(3 marks)**
- (ii) Makara Institute of Catering Services wishes to form a committee consisting of 2 members drawn from 5 customer care managers, 6 public relations officers and 4 senior chefs.

Required:

In how many ways can this be done?

(4 marks)

- (b) The management of Sayuni Enterprises wishes to select 2 members from Mark, Anna, Nobel, David and Lydia to represent other workers on the finance committee. Each of the 5 members has an equal chance of being selected.

Required:

- (i) Determine the number of ways the two members can be selected. **(2 Marks)**
- (ii) Calculate the probability that Nobel and David will be on the committee. **(2 marks)**
- (iii) Calculate the probability that Anna will be on the committee. **(1 mark)**

- (c) An outdoor concert featuring a popular musical group is scheduled for a performance on Sunday afternoon at Mandela National Stadium.

The promoter is worried about Sunday being a rainy day. He has contracted experts in weather forecasting, who predict the probability of the Sunday being rainy to be 0.24. If it does not rain, the promoter is certain of collecting Shs 100 million and if it rains, he estimates to collect only Shs 10 million.

An insurance company agrees to insure the concert for Shs 100 million against rain at a premium of Shs 20 million.

Required:

Advise the promoter whether he should buy the insurance.

(8 marks)

(Total 20 marks)

Question 3

- (a) Differentiate $y = (x^3 - 1)^4$ with respect to x . **(3 marks)**
- (b) A manager of Kimwe Kamwe Enterprise has analysed operating conditions of the company and has developed the following functions:
 Revenue $R = 50x - x^2$ and
 Cost $C = \frac{1}{3}x^3 - 9x^2 + 89x + 50$.

Where x are the number of units produced.

Required:

- (i) What is the profit maximizing condition. **(1 mark)**
 (ii) Calculate the output level that will maximize profit. **(6 marks)**
 (iii) Calculate the revenue, cost and profit where profit is maximized. **(3 marks)**
- (c) An accountant presented the following data about their company's profit, in million shillings, for a three year period.

Year (x)	1	2	3
Profit (y)	5	13	26

Required:

- (i) Determine a , b and c given the quadratic profit equation $y = ax^2 + bx + c$. **(5 marks)**
 (ii) Use the profit equation to predict the profit in the 4th year. **(2 marks)**
(Total 20 marks)

Question 4

- (a) Identify **four** main properties that suit a t-distribution. **(4 marks)**
- (b) The weekly wages of 2000 workers in a coffee factory are normally distributed with a mean of Shs 200,000 and variance of 400,000.

Required:

Estimate the weekly wages of 197 highest paid workers.

- (6 marks)**
- (c) The Minister for Local Government has received complaints that the Local Council V (LCV) chairpersons in Western Uganda and Eastern Uganda earn different salaries. Samples of 12 chairpersons from Western Uganda and

10 from Eastern Uganda have been studied and the following data obtained:

	Western	Eastern
Sample size	12	10
Average Annual Salary (Shs million)	1,050	980
Standard deviation	68	74

Based on experience the LCV chairpersons' salaries are normally distributed and their standard deviations are approximately equal.

Required:

- (i) Give **one** reason why a t-test is the most appropriate test to use.
(2 marks)
 - (ii) Use a t-test to test the complaint at 5% level of significance.
(8 marks)
- (Total 20 marks)**

SECTION B

Question 5

- (a) Distinguish between regression and correlation.
(4 marks)
- (b) The training officer of Xerox Consult extracted the following data from a trainee's notebook:

Variable x	17	11	8	13	5	7	9	14	10	6
Variable y	45	39	30	42	18	26	32	43	35	20

$$\begin{aligned}\sum x &= 100 & \sum y &= 330 \\ \sum x^2 &= 1130 & \sum y^2 &= 11708 \\ \sum xy &= 3,612\end{aligned}$$

Required:

- (i) Calculate the coefficient of correlation between the x and y variables and interpret the results.
(6 marks)
 - (ii) Calculate the values of a and b in the regression equation $y = a + bx$.
(6 marks)
 - (iii) Plot the x and y values and the regression line on the same axes.
(4 marks)
- (Total 20 marks)**

Question 6

- (a) Briefly define the terms **slack variable** and **dual** in the context of linear programming.

(2 marks)

- (b) Give any **four** limitations of the graphical method in solving linear programming problems.

(4 marks)

- (c) A shoe manufacturer makes two types of tennis shoes, the Court and the Great.

The manufacturer has a contract to supply at least 5,000 pairs of shoes; of which at least 2,000 must be the Court model. Only 18,000 minutes of machine time are available on the machines that make tennis shoes.

A pair of the Court model takes 2 minutes and that of the Great model 3 minutes of machine time.

The profit, in thousands on each pair, is Shs 3 for the Court model and Shs 4 for the Great model.

Required:

Using any appropriate method, determine the:

- (i) number of pairs of each model which should be made in order to maximize profit.
(ii) maximum profit.

(14 marks)

(Total 20 marks)

Question 7

- (a) The following table gives the cost of living index numbers for different commodity groups together with respective weights for 2004, base year 2001.

Group	Food	Clothing	Fuel	Rent	Miscellaneous
Group index	425	475	300	400	250
Group weight	62	4	6	12	16

Suppose a person was earning Shs 600,000 in 2001;

Required:

Determine:

- (i) the cost of living index number. **(8 marks)**
- (ii) what the salary of the person in 2008 should be, if the standard of living in 2008 remained the same as in 2001. **(2 marks)**
- (b) A project consisting 6 main activities A - F has 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 table below shows the normal duration of each activity in weeks:

Activity	A	B	C	D	E	F
Duration	4	5	4	1	2	3

Required:

- (i) Draw a logical network of activities based on normal duration for the project. **(6 marks)**
- (ii) Determine the critical activities and duration of the project. **(4 marks)**

(Total 20 marks)

PERCENTAGE POINTS OF STUDENT'S t -DISTRIBUTION, t_Q

ν	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	120	
28	0.683	1.313	1.701	2.048	2.467	2.763	3.047	3.408	3.674	ν	
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		4
40	0.681	1.303	1.684	2.021	2.423	2.704	2.971	3.307	3.551		3
60	0.679	1.296	1.671	2.000	2.390	2.660	2.915	3.232	3.460		2
120	0.677	1.289	1.658	1.980	2.358	2.617	2.860	3.160	3.373		1
∞	0.674	1.282	1.645	1.960	2.326	2.576	2.807	3.090	3.291		0

The function tabulated is t_Q defined by

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

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

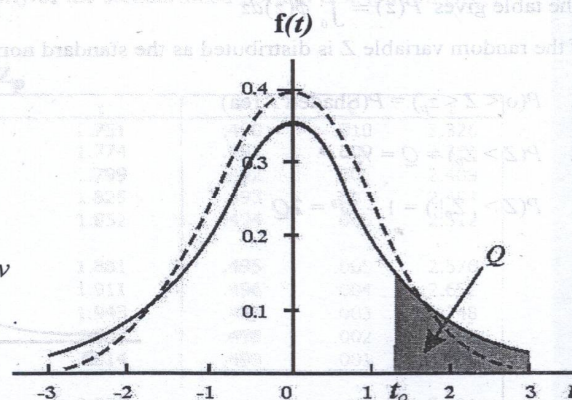
Interpolation ν -wise should be linear in $120/\nu$ for $\nu > 30$.

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 ν 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 ν the distribution approximates to the normal distribution $N(0,1)$, shown by the dotted line.



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	4957	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. $P(Z > |z_p|) = 1 - 2P = 2Q$

