CERTIFIED PUBLIC ACCOUNTANT

FOUNDATION 1 EXAMINATIONS

F1.1: BUSINESS MATHEMATICS AND QUANTITATIVE METHODS

MONDAY: 28 NOVEMBER 2016

INSTRUCTIONS:

1. **Time Allowed: 3 hours 15 minutes** (15 minutes reading and 3 hours writing).

2. This examination has **seven** questions and only **five** questions are to be attempted.

3. Marks allocated to each question are shown at the end of the question.

4. Show all your workings.

5. All iCPAR Examination rules and regulations apply.

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QUESTION ONE

(a)   Identify any four sources of secondary data when undertaking a baseline survey.   **(4 Marks)**

(b)   Outline any four scenarios indicating misuse of statistics.   **(4 Marks)**

(c)   Pauline secured a loan of Frw 5 million over 3 years at 18% per annum.

REQUIRED:

Calculate the monthly repayment that she will pay to amortise the loan.   **(6 Marks)**

(d)   The table below shows the value of output (in million Frw) from three companies A, B and C for a period of 3 years.

Company	Year		
	2009	2010	2011
A	555	805	826
B	390	419	709
C	350	472	550

REQUIRED:

Represent the information on a percentage component bar chart.   **(6 Marks)**

(Total 20 Marks)

QUESTION TWO

(a)   The frequency distribution table below shows the class boundaries of marks scored by 70 candidates in a Business Mathematics and Quantitative Methods mock examinations at one of the leading CPA training college in Kigali.

Marks (%)	Frequency (f)
94.5 – 99.5	4
89.5 – 94.5	6
84.5 – 89.5	7
79.5 – 84.5	10
74.5 – 79.5	16
69.5 – 74.5	9
64.5 – 69.5	7
59.5 – 64.5	4
54.5 – 59.5	4
49.5 – 54.5	2
44.5 – 49.5	1

REQUIRED:

(i)   Determine the mean mark.   **(3 Marks)**
(ii)   Find the quartile deviation.   **(5 Marks)**
(iii)   Calculate the modal mark.   **(3 Marks)**

(b) At Mackenzie General Supplies Limited (MGSL), the accounts department made a study of cheques it received for payment of goods and services from customers. It was found that 0.5% of all cheques received had insufficient funds to cover them. The accounts assistant also discovered that 40% of the cheques with insufficient funds had wrong dates on them while 2% of those with sufficient funds also had wrong dates on them.

REQUIRED:

(i)   Represent the above situation on a probability tree diagram. **(3 Marks)**

(ii)   If the accounts assistant receives a cheque from a customer, determine the probability that it has:

- Insufficient funds and a wrong date. **(2 Marks)**
- wrong date given it has insufficient funds **(1 Mark)**
- Insufficient funds given it has a wrong date. **(3 Marks)**

(Total 20 Marks)

QUESTION THREE

(i) Define the terms 'Type I error' and 'Type II error' as applied in hypothesis testing. **(4 Marks)**

(ii) It's claimed that 20% of the nails manufactured by KK steel rolling mill in Kigali are defective.

REQUIRED:

Calculate the probability that in a sample of nine nails, five are not defective. **(6 Marks)**

(b) The thickness of iron sheets manufactured at a factory located in Gasabo District is normally distributed with a mean thickness of 5 mm and standard deviation of 2 mm.

REQUIRED:

In a sample of 81 iron sheets, calculate the probability that an iron sheet selected at random has a thickness less than 4.9 mm. **(5 Marks)**

(c) In Ruhengeri, a random sample of 36 households was selected and their average daily expenditure on food items was found to be Frw 2,688 with a standard deviation of Frw 537.6.

REQUIRED:

Determine the 90 % confidence interval of mean daily expenditure in Ruhengeri. **(5 Marks)**

(Total 20 Marks)

QUESTION FOUR

(a) Outline any two uses of time series. **(2 Marks)**

(b) The table below shows the units of labour (x) employed to produce different levels of output (y) (tonnes).

x	27	30	37	38	32	36	32	32	38	42	36	44	33	38
y	118	136	156	150	140	155	157	114	144	159	149	170	131	160

REQUIRED:

(i) Plot the data on a scatter diagram. **(3 Marks)**

(ii) Calculate the product-moment coefficient of correlation. **(7 Marks)**

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(c)   The following table shows the various prices (Frw) of a commodity recorded from 2013 to 2015.

Year	Quarter			
	1	2	3	4
2013	78	62	70	56
2014	64	84	61	82
2015	70	92	85	63

REQUIRED:

(i)   Compute the 3 quarter moving totals and averages.   **(2 Marks)**

(ii)   Plot the original data values and the moving averages on a single chart.   **(6 Marks)**

(Total 20 Marks)

QUESTION FIVE

(a)   (i) Describe the chain base method for constructing price indices.   **(2 Marks)**

(ii) Identify any one major merit of the chain base method of constructing index numbers. **(1 Mark)**

(b)   Mackenzie International Ltd (MIL) is a marketing company dealing in produce. In 2014 and 2015 they sold their four major products W, X, Y and Z as shown in the table below (prices and the values in millions of Frw).

Year	2014		2015	
Item	Price	Value	Price	Value
W	190	950	210	1,260
X	210	1,680	230	1,840
Y	270	2,700	310	2,480
Z	255	3,060	315	3,150

REQUIRED:

(i) Determine the quantity of each item sold for year 2014.   **(2 Marks)**

(ii) Calculate the Paasche's quantity index for MIL for 2015 taking 2014 as base year. **(6 Marks)**

(iii) Comment on the value obtained in b (ii) above.   **(1 Mark)**

(c)   A business tycoon is said to be in advanced stage of setting up a shoe manufacturing factory in Kibuye. The factory is to produce shoes for both boys and girls. Two machines X and Y are to be used. X handles the preliminary stage up to giving the shoe the basic shape while Y will be used for detailed fine finishing. In the testing phase of the machines, X takes 3 and 4 hours to complete work on the boys' and girls' pair of shoes respectively while Y takes 2 and 5 hours to complete work on the boys' and girls' pair of shoes respectively. X and Y have a maximum test time of 162 and 150 hours respectively. The profit of Frw 1,500 is to be earned from the sale of each pair of boys' shoes and Frw 2,000 from a pair of girls' shoes.

REQUIRED:

Given that x_1 and x_2 are pairs of boys' and girls' shoes produced and sold respectively during the testing phase;

(i) Formulate a linear programming model for maximising profit, Z earned at the testing. **(4 Marks)**

(ii) Use the linear programming model in c (i) above to generate the initial tableau.   **(4 Marks)**

(Total 20 Marks)

QUESTION SIX

(a) Explain any three types of float in network analysis. **(6 Marks)**

(b) Habimana Express Travelers Limited (HETL) controls a number of cars that are operated by different drivers, Aine, Kaganda, Butare and Mutesi. On one day the company had four bookings to pick tourists from four different hotels Akagera (A), Laico (L), Serena (S) and Nyungwe (N) for the 6:00 am flight. The table below shows the time, in minutes, it will take each driver to get from their homes to the respective hotels.

	A	L	S	N
Aine	60	40	50	30
Kaganda	90	40	60	60
Butare	30	60	40	70
Mutesi	40	70	100	60

REQUIRED:

(i) Using the assignment technique, obtain the minimum time to be taken by the drivers for picking the tourists from their respective hotels. **(10 Marks)**

(ii) Advise the management of HETL on which driver should go to which hotel to pick the tourist. **(4 Marks)**

(Total 20 Marks)

QUESTION SEVEN

(a) Explain how samples can be obtained from a population using systematic sampling approach. **(3 Marks)**

(b) Two locations A and B in Kigali are under consideration for a new fast foods franchise. Expert count of customers reveal that location A can expect 50% of its customers in the morning hours, 20% in the afternoon hours and 30% in the evening hours. On the other hand location B can expect 25% of its customers in the morning hours, 20% in the afternoon hours and 55% in the evening hours. Statistics records from the parent company show that a typical customer spends Frw 2,500 in the morning, Frw 2,000 in the afternoon and Frw 4,500 in the evening.

REQUIRED:

(i) Determine the expected monetary value at each location **(4 Marks)**

(ii) Advise on the location that offers better business for the new franchise. **(1 Mark)**

(iii) Assuming that each location is projected to have 1500 customers per day; advise on the location that would lead to larger revenue. **(2 Marks)**

(c) Briefly explain the following concepts as applied in game theory.

(i) Strictly determined. **(1 Mark)**

(ii) Saddle value. **(1 Mark)**

(iii) Fair game. **(3 Marks)**

(d) The following is a payoff matrix that is associated with a two person zero-sum game.

$$\begin{pmatrix} 1 & -1 & -3 \\ -1 & 1 & -2 \\ 2 & 5 & -4 \end{pmatrix}$$

REQUIRED:

Determine whether the game is strictly determined, the saddle value and the best strategy for the row and column players.

(5 Marks)

(Total 20 Marks)

CUMULATIVE NORMAL DISTRIBUTION $P(z)$

Z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
														ADD					
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. $P(o < Z < z_p) = P(\text{Shaded Area})$

2. $P(Z > Z_p) = Q = \frac{1}{2} - P$

3. $P(Z > |Z_p|) = 1 - 2P = 2Q$
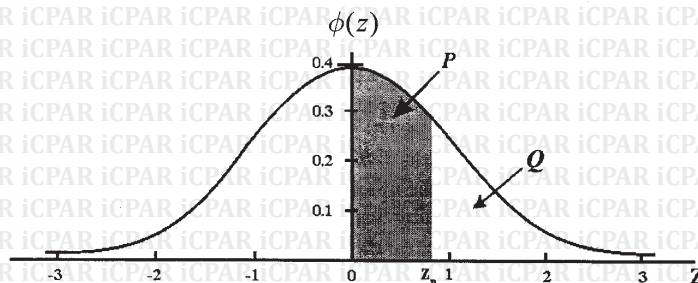
End of question paper

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