



ICPAR
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**CERTIFIED PUBLIC ACCOUNTANT
FOUNDATION LEVEL 1 EXAMINATION
F1.1: BUSINESS MATHEMATICS AND
QUANTITATIVE METHODS**

DATE: THURSDAY, 28 JULY 2022

INSTRUCTIONS:

- 1. Time Allowed: 3 hours 15 minutes** (15 minutes reading and 3 hours writing).
- This examination has **seven** questions and only **FIVE** questions **should** be attempted.
- Marks allocated to each question are shown at the end of the question.
- Show all your workings where applicable.
- The question paper should not be taken out of the examination room.

QUESTION ONE

a) ICPAR conference organizer committee is to decide breakfast menu. Two alternatives are to be offered bread and omelette where the cost per unit being FRW 2,000 and FRW 3,000 respectively. It is also decided that on an average the breakfast should provide at least 20 and 30 mgs of vitamin A and B respectively so that the participants can be healthy. If each unit of bread provides 5 mgs of vitamin A as well as 5 mgs of vitamin B and each unit of omelette provides 5 mgs and 10 mgs of vitamin A and B respectively.

Required:

By using graphical methods find the least-cost menu subject to nutrition requirements.

(10 Marks)

A production company has three supply point and can dispatch goods to four different market (M1, M2, M3 and M4). The transportation cost (in Thousands Rwandan Francs) of goods from supply point to demand point are given in the following table.

Particulars	M1	M2	M3	M4	Total supply
supply point F1	11	20	7	8	50
supply point F2	21	16	10	12	40
supply point F3	8	12	18	9	70
Total demand	30	25	35	40	

Required:

i) Draw a network model of transportation problem.

(2 Marks)

ii) Solve the problem by using Vogel Approximation method

(8 Marks)

(Total: 20 Marks)

QUESTION TWO

A company has recognized that its competitors are taking over their clients. They decide to launch a new strategy of advertising. The table below shows advertising expenditure (X) and sales (Y) in million Rwandan francs.

X	4	17	3	21	10	8	4	9	13	12	2	6	15	8	19
Y	13	47	24	41	29	33	28	38	46	32	14	22	26	21	50

Required:

a) Calculate the coefficient of correlation and interpret the result.

(12 Marks)

b) Find the linear equation fitting the data given above.

(3 Marks)

c) What would be the value of sales (Y), if expenditures (X) were FRW 45 million

(1 Mark)

d) Calculate the coefficient of determination and interpret the result.

(1 Mark)

e) Calculate the level of contribution of other factors to the sales not considered in the problem.

(1 Mark)

f) Calculate the standard error for the regression.

(2 Marks)

(Total: 20 Marks)

QUESTION THREE

a) Two direct competitor's companies A and B selling spare parts have recently conducted advertising campaign. At the outset, the market share of company A was 45% whereas company B has 40%, other competition accounted for the remaining 15%. After advertisement campaign, a marketing analyst solicited the preferences of a random sample of 200 customers from whom the data below was collected. 102 customers showed preferences for company A's spare parts, 82 preferred those for company B while 16 indicated preferences for other competitors' spare parts.

Required:

By using chi-square test, does the analyst infer at 5% ($\alpha = 0.05$) significance level that the customer preferences changed after the advertising campaign was launched? It is given by Chi-square critical is 5.9914 (10 Marks)

b) Kawunga manufacturing (KM) Ltd is considering whether to enter a very competitive market in Kigali. In case KM Ltd decides to enter this market, it must either install a new processing machine or pay overtime wages to the entire workers. In either case, the market entry could result in (a) high sales, (b) medium sales, (c) low sales, (d) no sales. The management of KM Ltd has estimated that, if they enter the market there is 65% chance of their shareholders approving the installation of the new machine and 35% chance of using overtime. A random sample of the current market structure reveals that KM Ltd has a 40% chance of achieving high sales, a 30% chance of achieving medium sales, 20% chance of achieving low sales, and a 10% chance of achieving no sales. Market analysts of KM Ltd have indicated that a high level of sales will yield FRW 1,100,000 profit; medium sales yield FRW 650,000; a low level of sales will result in a FRW 250,000 profit; and a no sales level will cause KM Ltd a loss of FRW 600,000 apart from the cost of any equipment. If entering the market will require a cash outlay of either FRW 300,000 to purchase and install a Machine or FRW 200,000 for overtime expenses, should the second option be selected?

Required:

i) Construct an appropriate decision tree and determine the joint probabilities for various branches. (9 Marks)

ii) Which is best strategy KM Ltd will choose (1 Mark)

(Total: 20 Marks)

QUESTION FOUR

Product manager of Kamonyi manufacturing company has planned a list of activities culminating in the inaugurate launch of the new product called Agasusuruko. The activities and duration times in days required for the exercise are listed in the table with preceding activities.

Activity	Pessimistic	Mostly likely	Optimistic	Immediate predecessor
A	21	10	5	-
B	15	7	5	-
C	12	10	8	A
D	40	20	6	C
E	90	60	30	D
F	13	10	7	D
G	52	30	20	C
H	12	10	8	F,G
I	66	50	34	B
J	1	1	1	E,H,I

Required:

- Calculate the expected duration of the project (5 Marks)
 - Draw a network diagram for the project and indicate on it the Earliest Start Time and Latest Start Time for each activity. (10 Marks)
 - Find the critical path for the project. (1 Mark)
 - What is the probability that the product manager will be able to complete the Agasusuruko launch within 80 days-time? (4 Marks)
- (Total: 20 Marks)**

QUESTION FIVE

a) A manufacturer estimates that when x thousand units of a particular commodity are produced every month, the total cost of production will be $C(x) = 0.4x^2 + 3x + 40$ thousand Rwandan Francs, and all x units can be sold at a price of $p(x) = 22.2 - 1.2x$ Rwandan Francs per unit Ltd estimates that when

Required:

- Find the level of output that results in maximum profit. What is the maximum profit? (7 Marks)
- At what level of output is the average cost per unit minimized? (4 Marks)
- At what level of output is the average cost equal to the marginal cost? (3 Marks)

b) Muhoza Ltd sells goods and makes a profit over eight years as it is illustrated in the Table below:

Year	2011	2012	2013	2014	2015	2016	2017	2018
Profit in (FRW Billions)	15,420	15,470	15,520	21,020	26,500	31,950	35,600	43,900

Required:

Find the trend of profit by using three years moving average.

(6 Marks)

(Total: 20 Marks)

QUESTION SIX

a) John is paid FRW 8 if two coins turn both heads and FRW 1 if two coins turn both tails. Peter is paid FRW 3 when the two coins do not match.

Required:

By using mixed strategy, find the value of the game

(10 Marks)

b) The director of agency has identified three acceptable alternatives to handle the increased workload. One is to reassign present staff members, another is to hire and train two new workers, and the third is to redesign current practice so that workers can readily collect the information with little additional effort. An unknown factor is the workload for the coming year, during which time the new data will be collected on a trial basis. The estimated costs (in FRW '000') for various options and workload are shown in the table that follows:

Particulars	Moderate	High	Very high
Reassign	50	60	85
New staff	60	60	60
Redesign collection	40	50	90

Assuming that probabilities of various caseloads are unreliable, based on past experience, what decision would be appropriate using each of the following criteria?

Required:

i. **Maximin** (1 Mark)

ii. **Maximax** (1 Mark)

iii. **Minimax regret** (2 Marks)

iv. **Principle of insufficient reason** (2 Marks)

v. **Hurwitz criteria by considering $\alpha = 0.3$ as the coefficient** (4 Marks)

(Total: 20 Marks)

QUESTION SEVEN

a) Ten customers went to the supermarket to purchase goods for Christmas.

Required:

If the probability of purchase is 0.30, what is the probability of making exactly 4 sales to 10 potential customers. (3 Marks)

b) A lecturer of statistics has observed that the number of typing errors in new edition of text books varies considerably from book to book. After some analysis he concludes that the number of errors is a Poisson distribution with a mean 1.5 per 100 pages. the lecturer receives a copy of the new book and he noticed that there are 400 pages.

Required:

i) **What is the probability that there are no typing errors?** (4 Marks)

ii) **What is the probability that there are five or fewer typing errors?** (3 Marks)

c) Assume that examination grades consist of one final exam and 2 mid-term tests. If each of the 3 grades are given different weights, given that the final examination is 50% of the grade and each mid-term assignment 25%.

Required:

Find the weighted arithmetic mean if a student gets 80 in the final exam, 95 in the first mid-term and 85 in the second mid-term assignment. (6 Marks)

d) **State three measures of location and three measures of variability** (3 Marks)

e) The performance of two sites of ICPAR A and B has the standards deviation of 2.5 and 4.2 respectively. **Which site performs better and why?** (1 Mark)

(Total: 20 Marks)

End of question paper

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00006	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414

