
CERTIFIED ACCOUNTING TECHNICIAN
LEVEL 1 EXAMINATION

L1.4: BUSINESS MATHEMATICS

WEDNESDAY: 5 DECEMBER 2018

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, where applicable.

QUESTION ONE

- (a) An officer in a microfinance company closed her day's business serving two clients who deposited RWF 70,348 and RWF 25,847,043. While compiling her report, she quoted her transactions to the nearest RWF thousand or million Rwandan Francs respectively for the two clients.

REQUIRED:

- (i) State the approximate values of RWF 70,348 and RWF 25,847,043 in the report. **(2 Marks)**
- (ii) Express the approximate value of RWF 70,348 as a percentage of the approximate value of RWF 25,847,043, giving your answer to 2 significant figures. **(2 Marks)**

- (b) Gahigi and Dukuzumuremyi held a business meeting at Nyungwe Top View Hill Hotel. After the meeting they realised that they had over spent their budget by RWF 220,000. To meet the extra bill Dukuzumuremyi contributed an amount less than that of Gahigi by RWF 44,000.

REQUIRED:

Determine:

- (i) Gahigi's contribution to meet the extra bill. **(3 Marks)**
- (ii) The ratio of Dukuzumuremyi's contribution to meet the extra bill to that of Gahigi's. **(3 Marks)**
- (c) Uwimana Jackie, a phone dealer in Nyaruguru district is promoting two mobile phones branded Mega and Blast. On the first day she sold 10 Mega and 15 Blast phones, making RWF 1,480,000. On the second day she made sales of 10 Blast phones and 15 Mega phones making RWF 1,445,000.

REQUIRED:

- (i) Determine the promotion price for a Mega and a Blast phone using the matrix method. **(6 Marks)**
- (ii) State the amount of money made on the third day when she sold 20 phones of which 12 were Mega and 8 Blast. **(2 Marks)**
- (iii) If the brands were of the same quality; state, giving a reason, the brand you would recommend to the public. **(2 Marks)**

(Total 20 Marks)

QUESTION TWO

- (a) Distinguish between risk and uncertainty as used in business. **(3 Marks)**
- (b) On admission to the college, a student has probability of $\frac{1}{4}$ of getting married while at college and a probability of $\frac{7}{10}$ of graduating. Given that the events of getting married and graduating are independent;

REQUIRED:

Determine the probability that a student selected at random is:

- (i) A graduate and married. **(2 Marks)**
- (ii) Married or does not graduate. **(3 Marks)**
- (c) Gzt Oil Company Limited normally carries out preliminary tests before the drilling of oil at any given location. Statistics show that 2 in every 10 tests confirm the availability of oil (success) at the location.

REQUIRED:

Use a probability tree diagram to determine the probability of getting a success on the third test in a series of 3 tests. **(6 Marks)**

- (d) Six companies submitted their bids for the construction of a borehole. The table below shows the companies, their bid amounts (million RWF) and the probabilities of winning the tender.

Company	A	B	C	D	E	F
Bid amount	120	140	155	135	110	105
Probability	0.1	0.05	0.2	k	0.1	0.3

The condition for tender awards is that the company whose bid value is less than the expected value is dropped while the rest qualify for the next bidding.

REQUIRED:

- (i) Determine the value of k. **(2 Marks)**
- (ii) Calculate the expected value of the bidders' amount. **(3 Marks)**
- (iii) Find the companies that qualified for the next bidding race. **(1 Mark)**
- (Total 20 Marks)**

QUESTION THREE

- (a) In a feasibility study on the viability of Telecom companies in the country, the manager of Xtel Telecom Ltd followed the traffic of calls among the business community in Gasabo district in the already existing networks in May. The data collected is summarized in the table below:

Call range (minutes)	No. of people
124-133	5
134-143	18
144-153	40
154-163	24
164-173	7
174-183	4
184-193	2

REQUIRED:

- (i) Draw a histogram and use it to estimate the mode of the calls. **(3 Marks)**
 - (ii) Calculate the median number of calls made. **(4 Marks)**
 - (iii) Find the mean number of calls made using 158.5 as the working mean. **(5 Marks)**
 - (iv) Comment the skewness of the number of calls. **(2 Marks)**
- (b) Karongi General Stores Ltd buys eggs from contracted suppliers for export to the regional market. The supplies are normally distributed with mean 120 and variance 10.24 trays of eggs per week. Statistics show that suppliers with weekly supply of 35% or more always have their contracts maintained.

REQUIRED:

If Gasigwa supplies at least 121 trays per week; determine his minimum weekly proportion and whether his contract will be maintained. **(6 Marks)**
(Total 20 Marks)

QUESTION FOUR

- (a) (i) Define the term ‘correlation’. **(1 Mark)**
(ii) Identify any **two** uses of regression analysis. **(2 Marks)**
- (b) Two independent labour firms J and K are authorised to recruit qualified persons to work abroad. They administered an interview to 10 applicants and scored the candidates as shown in the following table.

Candidate	A	B	C	D	E	F	G	H	I	J
J score	17	32	27	22	60	45	72	45	60	45
K score	24	45	30	29	44	35	46	46	40	38

REQUIRED:

Compute the:

- (i) Spearman’s rank correlation coefficient. **(6 Marks)**
(ii) Karl Pearson’s correlation coefficient. **(7 Marks)**
(iii) Compare the two coefficients in (i) and (ii) above. **(1 Mark)**
- (c) The following table shows five different commodities with their corresponding prices in the years 2015 and 2016.

	2015	2016
Commodity	Price (RWF)	Price(RWF)
A	650	700
B	800	800
C	1,000	1,200
D	500	600
E	650	700

REQUIRED:

- Calculate a simple average of price relative using 2015 as a base year. **(3 Marks)**
(Total 20 Marks)

QUESTION FIVE

- (a) Explain any **three** limitations of forecasting **(3 Marks)**
- (b) The table below shows bags of maize and their respective amount of fertilizer: (bags) used in its production on ten different plots of land on Nyagatare District Farm Institute.

Bags of maize (y)	Bags of fertilizer (x)
20	6
35	10
32	9
42	13
45	17
39	11
43	14
26	7
30	8
18	5

REQUIRED:

Calculate the coefficients of the regression line $y = mx + c$. **(7 Marks)**

- (c) The following table shows the quarterly exports of maize, in metric tons, for the years 2015, 2016 and 2017.

Year	Quarter			
	1	2	3	4
2015	36.6	13.1	11.7	10.4
2016	15.6	25.2	14.1	18.0
2017	20.0	15.0	10.0	8.0

REQUIRED:

- (i) Compute the moving totals and moving averages of order 3. **(4 Marks)**
- (ii) Plot the original data and moving averages on same graph. **(5 Marks)**
- (iii) Draw the trend line. **(1 Mark)**

(Total 20 Marks)

QUESTION SIX

- (a) Define the term annuity and give any two examples. **(3 Marks)**
- (b) Palasiko Bizimana invested RWF 280,000 with an investment club in Kigali which gives compound interest of 20% per annum.

REQUIRED:

Determine:

- (i) How much interest that Bizimana will earn in two years if the interest is compounded quarterly. **(4 Marks)**
- (ii) How much more interest that Bizimana will earn in the same period of two years if after one year the club raises the interest rate to 24% per annum. **(7 Marks)**
- (c) Pioneers Business Ltd won a contract from the local government of Nyagatare district to establish and run a business venture in the district. Their cash flow projections (in 'RWF million') in the subsequent years are summarized as follows.

End of year	0	1	2	3	4
Revenue	-	10	15	40	52
Capital	50	18	10	10	-

REQUIRED:

Given that Pioneers Business Ltd expects to earn 8.5% per annum;

- (i) Determine their net present value. **(4 Marks)**
- (ii) Comment on your results. **(2 Marks)**

(Total 20 Marks)

QUESTION SEVEN

(a) Explain the following features of the Microsoft Excel window.

(i) Title bar. **(2 Marks)**

(ii) Workbook. **(2 Marks)**

(iii) Formula bar. **(2 Marks)**

(b) The following table shows a sample of quantities of the items that were sold by Ngoma Quality Supermarket at the given prices on a particular day.

Product code	Description	Quantity sold	Unit price, RWF	Sales, RWF
0001AB	Ream of paper	200	6000	M
0112 AG	Bar soap	720	875	N
0190FG	Bread	2030	Q	2,436,000
0173HA	Juice	R	6000	2,400,000
0199FT	Wine	S	8750	481,250
0698AC	Sugar	1000	T	750,000

REQUIRED:

Compute the values represented by M, N, Q, R, S and T. **(6 Marks)**

(c) Toyota Rwanda Limited sold a vehicle to Mugabo. He paid RWF 6 million and agreed to pay RWF 3.6 million annually for 5 years discounted at the rate of 8%.

REQUIRED:

Calculate the current value of the vehicle.

(8 Marks)
(Total 20 Marks)

FORMULAE

1.	Combination ${}^nC_r = \frac{n!}{(n-r)!r!}$		
2.	Permutations ${}^nP_r = \frac{n!}{(n-r)!}$		
3.	Mean of the binomial distribution = np		
4.	Standard deviation = \sqrt{npq}		
5.	Variance of the binomial distribution = $np(1-p)$		
6.	Standard error of population proportion $S_{ps} = \sqrt{\frac{pq}{n}}$		
7.	Spearman's rank correlation coefficient $r = 1 - \frac{6\sum d^2}{n(n^2-1)}$		
8.	Product moment coefficient of correlation = $\frac{n\sum xy - \sum x\sum y}{\sqrt{(n\sum x^2 - (\sum x)^2) \times (n\sum y^2 - (\sum y)^2)}}$		
9.	Cost slope	=	$\frac{\text{crash cost} - \text{normal cost}}{\text{normal time} - \text{crash time}}$
10.	Harmonic mean (ungrouped data) $hm = \frac{n}{\sum \frac{1}{x}}$		
11.	Sample mean	$\bar{x} = \frac{\sum x}{n}$	
12.	Harmonic mean (grouped data) $hm = \frac{n}{\sum \frac{f}{x}}$		
13.	Quartile coefficient of dispersion = $\frac{Q_3 - Q_1}{Q_3 + Q_1}$		
14.	Mean $\bar{x} = A + \frac{\sum fd}{\sum f}$	or	Mean $\bar{x} = \frac{\sum fx}{\sum f}$
15.	Median = $Lb + \left(\frac{\frac{N}{2} - Cfb}{fm} \right) C$		
16.	Mode = $lm + \left(\frac{d_1}{d_1 + d_2} \right) C$		

17.	Variance $Var(x) = \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2$		
18.	Standard deviation	$\delta = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$	$= \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$
19.	Sample standard deviation	$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$	
20.	Least squares regression equation of y on x is given by; $y = a + bx$		
21.	Where; $b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$	and	$a = \frac{\sum y}{n} - b \frac{\sum x}{n}$
22.	Least squares regression equation of x on y is given by; $x = c + dy$		
	Where $c = \frac{\sum x}{n} - d \frac{\sum y}{n}$	and	$d = \frac{n \sum xy - \sum x \sum y}{n \sum y^2 - (\sum y)^2}$
23.	Standardizing normal.		$z = \frac{\bar{x} - \mu}{\sigma}$
24.	Confidence interval for sample mean $= \bar{x} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$		
25.	$\chi^2 = \sum \frac{(O - E)^2}{E}$		
26.	Confidence interval of proportion $= p \pm z_{\alpha/2} \sqrt{\frac{pq}{n}}$		
27.	Pearson coefficient of skewness	$Sk = \frac{(\bar{x} - \text{mode})}{s_d}$	or $Sk = \frac{3(\bar{x} - \text{median})}{s_d}$
28.	Expectation $= \sum xP(X = x)$		
29.	Laspeyres' price index $= \frac{\sum (p_1 \times q_0)}{\sum (q_0 \times p_0)} \times 100$		
30.	Weighted aggregate price index $= \frac{\sum wv_n}{\sum wv_0} \times 100$		
31.	Additive law of probability; $P(A \cup B) = P(A) + P(B) - P(A \cap B)$		

32.	Conditional probability $P(A/B) = \frac{P(A \cap B)}{P(B)}$
33.	Independence of A, B $P(A/B) = P(A)$ or $P(A \cap B) = P(A) \times P(B)$
34.	Continuous compounding $A = P(1+r)^n + \frac{b(1+r)^n - b}{r}$
35.	Quotient rule of differentiation $f = \frac{vu^1 - uv^1}{v^2}$; where $f = \frac{u}{v}$
36.	$Paasche's Model = \frac{\sum (p_1 \times q_1)}{\sum (q_1 \times p_0)} \times 100$
37.	$Poisson Model P(X = x) = e^{-\lambda} \frac{\lambda^x}{x!}$
38.	Price relative index = $\frac{p_n}{p_0} \times 100$

CUMULATIVE NORMAL DISTRIBUTION $P(z)$

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

