

FOUNDATION LEVEL 1 EXAMINATIONS F1.1: BUSINESS MATHEMATICS AND OUANTITATIVE METHODS DATE: THURSDAY, 01 DECEMBER 2022

INSTRUCTIONS:

- 1. Fime Allowed: 3 hours 15 minutes (15 minutes reading and 2 leparnove 2022 lepa
- 2. This examination has seven questions and only five overquestions are constituted by the overquestions is common to the constitution of the constitutions is constituted by the constitution of the constitu
- 3. Marks allocated to each question are shown at the end of the provided to each question are shown at the end of the provided to parnove 2022 ICPARNOVE 202
- 4. Show all your workings where applicable.
- 5. The question paper should not be taken out of the armexamination 12 Icparnove 2022 Icparnove

 $\mathsf{F1.1}$ 2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove202 icparnove2022 Page lof $\mathsf{8}$

QUESTION ONE.

a) The number of typing errors, x, on each of 200 pages of a given book was monitored. The findings showed that $\sum x = 920$, arrow $\sum x^2 = 5032$,

Required:

i) Calculate the mean and standard deviation

(2 Marks)

ii) 50 more pages were monitored and it was found that the mean was 4.4 errors, and the standard deviation was 2.2 errors. PARNOVE 2022 ICPARNOVE 2022 ICPAR

Required:

Calculate the combined mean and the combined standard deviation of the number of errors noveled in particular in p

b) In physics laboratory, 31 candidates tried to estimate the length of a cable. Actually, the line was 60 mm long. The estimates of those candidates were: CPARNOVE2022 ICPARNOVE2022 I

22 ICPARNO' RN 64 E2022	ve2022 ic ic 70 rnov	VE246	E2022 CPARNO	1CPARNO 44 12022	$^{ m VE}_{ m IC}26_{ m N}$	$\frac{\text{ICPARNO}}{\text{OVE}_{20}}$	VE2022 ICPARN	100	OVE2022 2 ICP 85	ICPARN IOVE202	$52^{ m CPARN}$	ICPARN 0 44 022	OVE2022 2 ICP. 38	(O)
22 3CP ARNO RN 3 VE2022	VE4922 IC	PARNOV VE259	E2022 CPARNO	58 ^{ARNO}	$_{\rm IC}^{ m VE}$ $63^{\circ}_{ m N}$	ICPARMO OVE2022	VE2022 ICPARN	29 ₂₀₂	OVE2327 2 ICP3R	ICPARN	48 ^{E2022}	76 ₀₂₂	OVE261	(O)
2246 ARNO	VE3122 IC	PAR38V	E2022	41 ^{ARNO}	VE 49 ²	ICPARNS	VE2022	156 ^{ARN}	OVE 275	ICPARN	61 ^{E2022}	ICPARN	OVE2022	I(

Required:

Find the median and the quartiles of this distribution and use the quartiles to estimate the skewness. (4 Marks)

c) Group the frequency distribution from the table in b above into 7 equal continuous class converged to the frequency distribution from the table in b above into 7 equal continuous class converged to the frequency of the frequ

Required:

i) OV Calculate Mode ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 I(2 Marks)

ii) v Calculate Standard deviation CPARNOVE 2022 ICPARNOVE 2022 ICPARNOVE 2022 ICPARNOVE 2022 I (3 Marks)

riii) Calculate Coefficient of variation nove 2022 ICPARNOVE 2022 ICPARNOVE 2022 ICPARNOVE 2022 IC(ARMark)

(Total: 20 Marks)

 $61\sqrt{1}$ 2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove202 icparnove2022 $Page\ 2$ 0f8

QUESTION TWO

a) Since January 2020 at Gihozo supermarket, customers are encouraged to pay by credit card because of Covid-19 pandemic. A survey conducted in June 2021 showed that 60 % of customers pay by credit card. Assume that a sample of 10 customers was randomly selected.

Required:

i) What is the probability that exactly two customers pay by credit card? CPARNO	(5 Marks)	N
ii) What is the probability that more than seven customers pay by credit card?	(3 Marks)	N
arnovezozz icparnovezozz icparnovezozz icparnovezozz icparnovezozz icparnovezozz icparnovezozz icparnovezozz oz iii) PA Findthe mean and standard deviation of the distribution 2 icparnovezozz icparno	(2 Marks)	2: N

b) A company that produces vaccines for a pandemic stated that the vaccine had a 90 % success rate. A doctor questioned whether the vaccine would be as effective as the company claimed. He injected the vaccine to 15 patients. After six months, 11 of these patients reported that the vaccine had relieved their pandemic symptoms.

Required:

o2i) CPTest the vaccine company's claim at the 5% level of significance. NOVE 2022 ICPARNOW	(8 Marks)
varnove 2022 i cparnove 2022 i 02 ii): I Should the doctor keep vaccinating? varnove 2022 i cparnove 2022 i cparnove 2022 i cparnov	(2 Marks)
arnove2022 icparnove2022 icpar	0 Marks)

71v12022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE202 ICPARNOVE2022Page 30of 8

QUESTION THREE

- a) Explain briefly what you understand by:
- 22 ICPARNOVE2022 ICPÁRNOVE2022 ICPARNOVE2022 ICPÁRNOVE2022 B**i)** OV**Á population**2022 ICPÁRNOVE2022 ICPÁRNOVE2022 ICPÁRN

i) iCPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE ii) v**A sampling frame** parnove2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022 IC (IrMark)

- b) A researcher wants to take a sample from the following:
 - 1) Owners of Yego Carbs in Kigali city
 - 2) Residents of Kigali who tested positive for Covid-19 during June 2021

Required:

Suggest a suitable sampling frame in each case

(2 Marks)

(1 Mark)

- c) Describe how to choose a systematic sample of eight numbers from a list of 300 (3 Marks)
- d) PA three-sector economy consists of the agriculture, construction, and manufacturing sectors, which produce three essential goods: food, housing, and clothing. The input coefficient matrix is described by: ICPARNOVE2022 ICP

$$A = \begin{pmatrix} 0.3 & 0.5 & 0.2 \\ 0.2 & 0.0 & 0.5 \\ 0.1 & 0.3 & 0.1 \end{pmatrix}$$

If the final demand from those essential goods is 100, 40, and 50 respectively;

Required:

i) of Find the Leontief matrix arnove 2022 icparnove 2022 icparnove 2022 icparnove 2022 icparnove (3 Marks)

ii) Determine the total output needed to satisfy demand and the economy. (10 Marks)

(Total: 20 Marks)

QUESTION FOUR

a) XYZ Hardware is considering introducing a new computer system in one of its branch offices so that employees can work remotely. The company has the option of leasing a small, medium, or large computer system. If the economy continues to grow, the company estimates that the profit for small, medium and large systems will be FRW 100,000, FRW 150,000, and FRW 200,000, respectively. If the economy slows, the profit will be FRW 60,000, FRW 20,000, and a loss of FRW 20,000, respectively. The probability of continued expansion is estimated to be 0.4, while the probability of a slowdown is estimated to be 0.6.

Required:

Using the expected value approach, construct a decision tree diagram to summarize the above information and decide which computer system the company can choose. (7 Marks)

b) Dakota Company operates three factories in three districts. The factory's products are available in four supermarkets. The factories x, y, and z have weekly production capacities of 1000, 700, and 900 kilograms, respectively. Supermarkets A, B, C, and D have a total demand of 900, 800, 500, and 400 Kilograms, respectively. The following table shows the transportation cost per kilogram:

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Required:

- i) Formulate a mathematical model that summarizes the above information PARNOV (3 Marks)
- ii) Determine a suitable allocation to minimize the total cost, using North West Corner and Least Cost method, and comment on the results.
- iii) State three characteristics of the transportation problem? 2 ICPARNOVE 2022 ICPARN (1.5 Marks)

(Total: 20 Marks)

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QUESTION FIVE

22 CPARNOVE2022 ICPARNOVE2022 ICPARNOVE2022

predecessor time time time time time time time time	Activity	Activity2description2 icparnov	Immediate	Optimistic	Mostrnove	Pessimistic
A PARNOVE Lay the foundation Nove 2022 IC PARNOVE 2022 IC PARN	2 ICPARNOVE 2NOVE2022 IC	1022 ICPARNOVE2022 ICPARNOVE2022 IC PARNOVE2022 ICPARNOVE2022 ICPARNOV	predecessor	RNOVE2022 ICPAI O time arnove2	likely _{rnove}	ARNOVE2022 ICPAF 20 11me arnove20
B Lay the foundation A 2 3.5 8 C Put the rough wall B 6 9 18 D Put up the roof C 4 5.5 10 E Install the exterior plumbing C 1 4.5 5 F Install the interior plumbing I 4 4 10 G Put up the exterior siding D 5 6.5 11 H Do the exterior painting E, F 5 8 17 I Do the electrical work C 3 7.5 9 J Put up the wallboard I 3 9 9 K Install the flooring J 4 4 4 L Do the interior painting J 1 5.5 7 M Install the exterior fixtures H, G, K 1 2 3	2 ICPARNOVE 2NOVE2022 IC	022 ICPARNOVE2022 ICPARNOVE2022 IC ARNOVE2022 ICPARNOVE2022 ICPARNOV	PARNOVE2022 ICPA E2022 ICPARNOVE2	RNOVE2022 ICPAI 022 ICPARNOVE2	ncve2022 icpa 2 time arnove2	ARNOVE2022 ICPAF 2022 ICPARNOVE20
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Dearnove Put up the roof Charnove 2022 C	PARNOVE NOVE2022 IC	Lay the foundation NOVE 2022 ICPARNON	PARNOVEA022 ICPA E2022 ICPARNOVE2	RNOVE222 ICPAI 022 ICPARNOVE2	NOVE 3.5 2 ICPA 022 ICPARNOVE	ARNOVE2 8 2 ICPAR 2022 ICPARNOVE20
EPARNOVE Install the exterior plumbing ARNOV C 10 10 10 10 10 10 10	2 CPARNOVE2	Put the rough wall 2022 ICPARNON	PARNOVE R 022 ICPA E2022 ICPARNOVE2	RNOVE2 6 22 ICPAI	NOVE2 9 22 ICPA	ARNOVE2 18 2 ICPAR 2022 ICPARNOVE20
FPARNOVE Install the interior plumbing ARNOVEI 22 ICPA NOVE 24 2 ICPA NOVE 25	2 D PARNOVE2	Put up the roof ICPARNOVE2022 ICPARNOVE	PARNOVE 2 022 ICPA	RNOVE2 <mark>4</mark> 22 ICPAI	RNOV IS IS2 ICPA	ARNOVE2po2 ICPAR
GPARNOVE Put up the exterior siding 222 to Parnov D22 to Parnov E S22 to Parno	2 EPARNOVE	Install the exterior plumbing	PARNOVE 2 022 ICPA	RNOVE2122 ICPAR	RNOV I 52 ICPARNOVE	ARNOVE262 ICPAR
HPARNOVE Do the exterior painting 2022 IC PARNO E, F2 ICPA NOVE 252 ICPA NOVE 282 ICPA NOVE 2172 ICI ICPARNOVE Do the electrical work ve2022 IC PARNOV C022 ICPARNOVE 232 ICPA NOVE 292 ICPARNOVE Put up the wallboard ove2022 ICPARNOVE ICPARNOVE 232 ICPARNOVE 292 ICPARNOVE 292 ICPARNOVE Install the flooring RNOVE 2022 ICPARNOVE ICPARNOVE 242 ICPARNOVE 2	2 FCPARNOVE	Install the interior plumbing	PARNOVE 2022 ICPA	RNOVE2422 ICPA	RNOVE2 4 22 ICPA	ARNOVE2102 ICPAR
Icparnove Do the electrical work ve2022 ic parnov C022 icparnove2322 icparnov 7.52 icp. knove292 icparnove292	2 G PARNOVE	Put up the exterior siding 22 10	PARNOVE DO LE LA PROVES	RNOVE2522 ICPAI	NOVI 6.5 2 ICPA	ARNOVE2112 ICPAR
JOPARNOVE Put up the wallboard OVE2022 IC PARNOVE 1022 ICPARNOVE 2322 ICPARNOVE 2922 ICPARNOVE 2	2 HPARNOVE	Do the exterior painting 2022 10	PARNOE, P2 ICPA	RNOVE2522 ICPAI	NOVE2822 ICPA	ARNOVE2 \7 2 ICPAR
Kparnove Install the flooring knove2022 ic parnoveJ022 icparnove242 ic	2 ICPARNOVE	Do the electrical work	PARNOVI C 022 ICPA	RNOVE2322 ICPAR	RNOVE 252 ICP	ARNOVE2 9 2 ICPAR
Learnove Do the interior painting 2022 ic parnove Jo22 ic parnove 2122 ic parn	$_{2}$ $_{\rm J_{CPARNOVE}}$	Put up the wallboard OVE2022 10	PARNOVE 2022 ICPA	RNOVE2322 ICPAR	RNOVE2922 ICPA	1000000000000000000000000000000000000
M_{ARNOVE} Install the exterior fixtures 2 10 Par H, G, $K_{\text{1CPARNOVE}}$ 122 1CPARNOVE 22 1 CPARNOVE 32 1CPARNOVE	${}_{2}\overset{\text{NOVE2022}}{\mathbf{K}}{}_{ ext{PARNOVE2}}$	l	PARNOVEZ022 ICPA	RNOVE2	NOVE2422 ICPARNOVE	4RNOVE2 4 2 ICPAF
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1 Nparnove chistant die interior fixtures 22 icparnovi, L2 icparnove 2522 icparnov 2532 icparnove 2922 ici	NOVE2022 IC 2 PARNOVE	Install the interior fixtures	$\stackrel{ ext{E2022}}{\text{PARNOM}}_{2}\stackrel{ ext{E2022}}{\text{L2}}_{2}$ ICPA	1022 ICPARNOVE2 RNOVE2922 ICPAI	022 ICPARNOVE: RNOVE 202 2 ICPA	2022 ICPARNOVE20 ARNOVE2022 ICPAR

RNOVE2022 ICPA 22 ICPARNOVE202 Required:

¹²² a)	CPACIONETRICE, PARNOVE 10 PARNOVE 2022 ICPARNOVE 20	Marks)
b)	CPAFING the critical path ICPARNOVE2022 ICPA	Marks)
² c)	Calculate the mean and the variance of the project. OVE 2022 ICPARNOVE 2022 ICPARNOV (5	Marks)
² d)	PExplain the concept of crashing of a project 22 ICPARNOVE 2022 IC	Marks)
arno 02 e) 0	CPAExplain the criteria for selecting an activity to be crashed ICPAEXPORT (2)	Marks)
ARNO 022 IO	ove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icpa icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 icparnove2022 (Total:20)	rnove202 Marks)

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QUESTION SIX

a) A finalist at a particular university conducted research and found the data for person's age (x) 12 JANNOVE 2022 12 JANNOVE

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i) CFind the regression line equation for Age(x) related to income(y) OVE2022 ICPARNOV (9 Marks)

ii) Use the equation obtained in (i) to estimate the age of Mathew if his income is 582

(2 Marks)

b) A zero- sum game has the following pay-off table for player 1 and player 2

N 2	Strategy 022 ICPARNOVE 2022 ICPARNOVE 2022	vPlayer Qrnove2022 icparnove2022 icparnove20
N	OVE2022 ICPARNOVE2022 ICPARNOVE2022	ICPARNOVE2022 ICHARNOVE2022 ICPARNOVE2022 IC
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2 INT		VE2022 ICPARNOVE2022 ICPARNOVE
Z Z	OVE2022 ICPARNOVE2022 ICPARNOVE2 p 22 ICPARNOVE2022 ICPARNOVE2022 ICPARNO	vezozz icparnovezozz icparnovezozz icparnovezozz icparnog ezozz icparnovezozz icparnov
N	OVE2022 ICPARNOVE2022 ICPARNOVE2	ICPARNOVE2022 2FARNOVE2022 ICPA3NOVE2022 ICPARNO4E2022 ICPARNOVE2322

i) Use maximin/minimax criteria to find a saddle point of the game, if any (3 Marks)

ii) Use the dominance principle to eliminate rows and/ or columns, if possible (3 Marks)

iii)Use algebraic methods to determine the solution and the value of the game 222 (3 Marks)

(Total: 20 Marks)

QUESTION SEVEN

a) The demand for a product in each of the five months is shown below:

2	CMonthe 2022 ICPARNOVE 2022 ICPARNOVE 2022 ICPAR	RNOVE2022 ICPARN	OVE2022 IOPA	RNOVE2022	ICPARNOVZ 20	22 ICPAKNO
N	TVIOITUI DVE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2	022 ICPARNOVE202	2 ICPARNOVE	2022 ICPARN	OVE2022 ICPA	RNOVE2022
2	Demand in Thousand (FRW) NOVE 2022 ICPA	RNOVE2022 ICP 13 N	OVE2022 17 PA	RNOVE 49 2	ICPARNO2320)22 ICP 24 N(
M	WE2022 ICPARNOVE2022 ICPARNOVE2022 ICPARNOVE2	022 ICPARNOVE202	D ICPARNOVE!	DOOD TOPARN	OVE2022 ICPA	RNOVE2022

Required:

Use a two-month moving average to generate a forecast for demand of the 6th month.

ii) 2 Apply exponential smoothing with 2a smoothing constant of 0.9 to calculate the forecasted demand of the 6th month (2.5 Marks)

iii) Which of these two forecasts do you prefer and explain why?

(2 Marks)

b) To produce a monthly consumer price index report, the national institute of statistics collects commodity data from various markets across the country. The product data have been collected on a monthly basis. The table below summarizes the prices of products that were collected in December 2020 and December 2021, as well as the quantity demanded in one of the markets from Kamonyi District

Commodity2 icparnovi	Prices in Decer	mber 2020 in 2 ICPARN	Prices in Decemb	ber 2021 in 2022 icpar
RNOVE2022 ICPARNOVE2022 IC 22 ICPARNOVE2022 ICPARNOVI	(FRW/Kg)	NOVE2022 ICPARNOVE202 2 ICPARNOVE2022 ICPARN	$(FRW/Kg)_{NOVF20}^{22 ICPA}$	RNOVE2022 ICPARNOVE20 122 ICPARNOVE2022 ICPAR
RNOVE2022 ICPARNOVE2022 IC	PARNOVE2022 IPôR	NOVE2022 ICPARNOV	2 ICPARNOVE2022 I P PA	RNOVE2022 ICPARNO 20
Irish potatoes Kinigi	PARNOVE2022 450 R	nove2022 icparn 5000 2	2 ICPARNOVE202 500 A	RNOVE2022 ICPAR 5400 0
22 ICPARNOVE2022 ICPARNOVI RN CASAVA ICPARNOVE2022 IO	2022 icparno 2	2 icparnove2022 $1000^{ m N}_2$	OVE2022 ICPARN 300° 2 ICPARNOVE202 300°	22 icparnove2021 $100^{ m R}$
Sweet potato ICPARNOVI	2022 ICPARNO 2302	2 ICPARNOVE202 15000 N	OVE2022 ICPARN3400	22 ICPARNOVE2013000R
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Required:

i) Calculate Laspeyres, Paasche and Fisher's ideal index number (7.5 Marks)

ii) State and explain four desirable properties of the base period in index number (6 Marks) (Total: 20 Marks)

End of question paper

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