AFRICA UNIVERSITY
(A United Methodist-Related Institution)

"Investing in Africa's Future"

COLLEGE OF BUSINESS, PEACE, LEADERSHIP AND GOVERNANCE

Operations Management (MMS506)

Final Examination – November 2019

Dr. S. Murairwa (PhD)

3 Hours

INSTRUCTIONS

Answer **All** questions.

Start **each** question on a new page in your answer booklet.

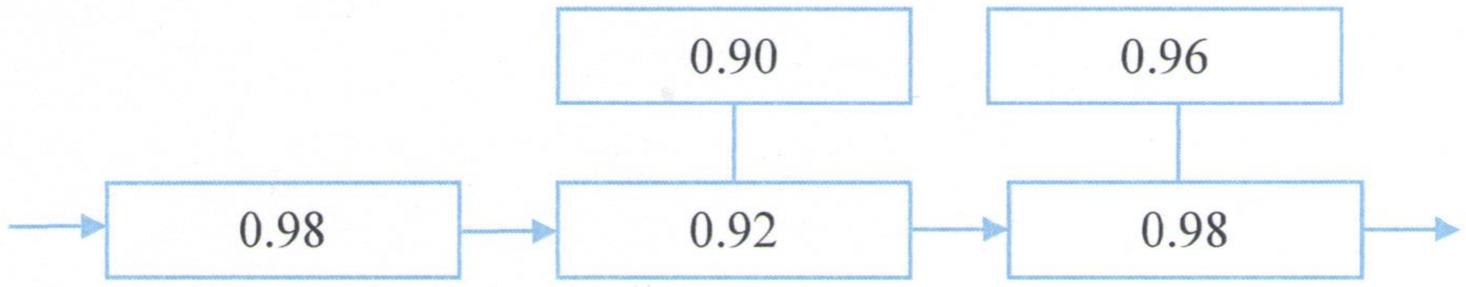
The marks allocated are shown at the end of **each** question.

Show all your workings where appropriate.

Credit will be given for logical, systematic and neat presentations.

1. MamaMia's Pizza is a small family oriented restaurant. Like any other business, MamaMia has three major management concerns; (1) Acquiring capital to start and continue to run the business – financial function, (2) attracting customers, selling and distribution – marketing function and (3) making products and delivery services – Operations function.
   a. Identify MamaMia's business customers and processes. **[4 marks]**
   b. Explain in detail why Production and Operations Management is necessary taking into consideration MamaMia's business challenges. **[4 marks]**
   c. Analyse the strengths and weaknesses of MamaMia's business. Justify some of your responses. **[6 marks]**
   d. Discuss the three production functions model (3PFM). **[8 marks]**
   e. Explain MamaMia's business design process. **[8 marks]**

2. A production system has four machines namely Robot (P_1), Turning Centre (P_2), Milling (P_3) and Grinder (P_4). If one machine is down, the whole production system is down. Assume that the reliability of the Robot, Turning Centre, Milling and Grinder are 0.99, 0.98, 0.99 and 0.96 respectively.
   a) Calculate the production system's total reliability and interpret. **[3 marks]**
   b) Suppose the system is redesigned with two grinders in parallel; if one grinder fails, the other grinder may still be working. Calculate the total reliability of the system. **[3 marks]**
   c) Calculate the reliability of the following production system **[3 marks]**



3. The following table provides the information necessary to construct a project network and project crash data:

Activity		Preceding	Time (Weeks)		Cost ($)	
			Normal	Crash	Normal	Crash
A	Clear site	-	16	8	2000	4400
B	Excavate	-	14	9	1000	1800
C	Pour foundation	**A**	8	6	500	700
D	Frame house	**A**	5	4	600	1300
E	Lay floor	**B**	4	2	1500	3000
F	Lay roof	**B**	6	4	800	1600
G	Plumbing	**C**	10	7	3000	4500
H	Finish	**D, E**	15	10	5000	8000

   a) Draw the network diagram and determine the duration of the project. **[6 marks]**
   b) Manually crash the network to 28 weeks. **[8 marks]**
   c) Formulate a linear programming crashing model that would crash this project by the maximum amount. **[12 marks]**

4. The Southern Textile Company is contemplating the future of one of its plants located in Mutare. Three alternative decisions are being considered (1) Expand the plant and produce lightweight, durable materials for possible sale to AU students, a market with little foreign competition; (2) maintains the status quo at the plant, continuing production of textile goods that are subject to heavy foreign competition and (3) sell the plant. More information is presented in the following payoff table.

Decisions	**States of Nature**	
	Good Foreign Competitive Conditions (RM)	Poor Foreign Competitive Conditions (RM)
Expand	800 00	500 000
Maintain Status Quo	1 300 000	-150 000
Sell	320 000	320 000

Determine the best decision using each of the decision criteria ($\alpha = 0.3$ where applicable).

a) Maximin **[2 Marks]**
b) Hurwicz **[4 Marks]**
c) Equal likelihood **[4 Marks]**
d) Given that 0.7 and 0.3 are probabilities that good foreign competitive conditions and poor conditions will exist respectively, determine the decision using expected value **[4 Marks]**

5. The demand for product A is 50 units. Each item of A requires 2 units of B and 3 units of C. Each unit of B requires 2 units of D and 3 units of E. Furthermore, each unit of C requires one unit of E and 2 units of F. Each unit of F requires one unit of G and 2 units of D.

a) Construct a product tree structure and calculate the number of units of each item required to satisfy demand. **[5 marks]**
b) Given the following lead time for each component; construct the Gross Material Requirements Plan for components A, B and C only. **[3 marks]**

Component	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Lead Time (weeks)	1	2	1	1	2	3	2

c) Given that the balances at hand for A = 10, B = 15 and C = 20, construct their net material requirements plans. **[5 marks]**
d) With a diagram, explain the Manufacturing Resource Planning (MRPII). How does it differs from Enterprise Resource Planning (ERP)? **[8 marks]**

End of Paper

Additional Information

1. Inventory and Project Management

Total Annual Cost - EOQ	Total Annual Cost-EPLS	Crashing
$TC = \frac{QC_h}{2} + \frac{DC_o}{Q} + DC$	$TC = \frac{1}{2}\left(1 - \frac{D}{P}\right)QC_h + \frac{DC_o}{Q} + DC$	$M = T_n - T_c$ $K = \frac{C_c - C_n}{M}$

2. Probabilistic Activity Times

Expected Value	Std dev of x	Expected time	Variance
$EV(x) = \sum_{i=1}^{n} p(x_i)x_i$	$Z = \frac{x - \mu}{\sigma}$	$t = \frac{a + 4m + b}{6}$	$\sigma^2 = \left(\frac{b - a}{6}\right)^2$

3. Control Charts

X bar Charts		R-Chart	C-Chart	P-Chart
$UCL = \bar{\bar{X}} + z\sigma_{\bar{X}}$ $LCL = \bar{\bar{X}} - z\sigma_{\bar{X}}$	$UCL = \bar{\bar{X}} + A_2\bar{R}$ $LCL = \bar{\bar{X}} - A_2\bar{R}$	$UCL = D_4\bar{R}$ $LCL = D_3\bar{R}$	$UCL = c + z\sqrt{c}$ $LCL = c - z\sqrt{c}$	$LCL = \bar{p} + 3s_{\bar{p}}$ $LCL = \bar{p} - 3s_{\bar{p}}$

4. Forecasting

Moving Average	Exponential Smoothing (ES)	Adjusted ES	Linear Trend
$MA_n = \frac{\sum_{i=1}^{n} D_i}{n}$	$F_{t+1} = \alpha D_t + (1 - \alpha)F_t$	$AF_{t+1} = F_{t+1} + T_{t+1}$	y = a + bx

5. MRP

Gross Requirements, Scheduled receipts, Projected on hand, Net Requirements, Planned Order Receipts and Planned Order Releases.