

# Theory Paper

VPM's  
DR VN BRIMS, Thane  
Programme: MMS (2021-23)  
Second Semester Regular Examination October 2022

<b>Course Name</b>	Operations Research	<b>Course Code</b>	MMS-2-C-03
<b>Roll No.</b>		<b>Marks</b>	60
<b>Total No. of Questions</b>	6	<b>Duration</b>	3 Hours
<b>Total No. of printed pages</b>	2	<b>Date</b>	10.10.2022

**Course Outcome Statements:**

- CO1:** Recall the concepts of operations research and relate them to business problems  
**CO2:** Interpret business insights for optimization of business problems  
**CO3:** Apply appropriate operations research tools in relevant business scenarios  
**CO4:** Examine the business problems and prescribe probable solutions  
**CO5:** Recommend alternate solutions to business problems

Instructions: -		Marks	BL	CO																
Q. No 1 (All Questions are Compulsory)																				
Q. No.	Questions																			
Q. 2	Answer <b>Any-one</b> from the following.																			
a.	Determine EOQ and total annual cost for the following inventory model D = 1,000 units P = \$10 S = \$10 per order      H = \$.50 per unit per year	6	Level 5	CO5																
b.	The price of a share of a particular stock listed on the New York Stock Exchange is currently \$39. The following probability distribution shows how the price per share is expected to change over a three-month period: <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Stock Price Change (\$)</th> <th style="text-align: center;">Probability</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">-2</td><td style="text-align: center;">0.05</td></tr> <tr><td style="text-align: center;">-1</td><td style="text-align: center;">0.10</td></tr> <tr><td style="text-align: center;">0</td><td style="text-align: center;">0.25</td></tr> <tr><td style="text-align: center;">+1</td><td style="text-align: center;">0.20</td></tr> <tr><td style="text-align: center;">+2</td><td style="text-align: center;">0.20</td></tr> <tr><td style="text-align: center;">+3</td><td style="text-align: center;">0.10</td></tr> <tr><td style="text-align: center;">+4</td><td style="text-align: center;">0.10</td></tr> </tbody> </table> <p>a. Set up intervals of random numbers that can be used to generate the change in stock price over a three-month period.  b. With the current price of \$39 per share and the random numbers 0.1091, 0.9407, 0.1941, and 0.8083, simulate the price per share for the next four 3-month periods. What is the ending simulated price per share?</p>	Stock Price Change (\$)	Probability	-2	0.05	-1	0.10	0	0.25	+1	0.20	+2	0.20	+3	0.10	+4	0.10	6	Level 5	CO5
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Q. 3	Answer the Q3.a from practical or Q3.b from theory																			
b.	You have the chance to invest in either a 7.5% bond that sells at face value or an aggressive growth stock that pays only a 1% dividend. If inflation is feared, the interest rate will go up to 8%, in which case the principal of the bond will go down by 10% and the stock value will go down by 20%. If recession materializes, the interest rate will go down to 6%. Under this condition, the principal value of the bond is expected to go up by 5% and the stock value will increase by 20%. If the economy remains the same, the stock value will go up by 8% and the bond principal will remain the same. Economists estimate a 20% chance that inflation will rise and a 15% chance that recession will set in. Represent the problem in a decision tree. Which would you invest	6	Level 4	CO4																

		in? Stock or Bond?																
<b>Q. 4</b>		Answer <b>Any two</b> from Q.4 a -Practical, Q4.b, Q4.c																
	<b>b.</b>	<p>The reference desk of a university library receives requests for assistance. Assume that a Poisson probability distribution with an arrival rate of 10 requests per hour can be used to describe the arrival pattern and that service times follow an exponential probability distribution with a service rate of 12 requests per hour.</p> <p>a. What is the probability that no requests for assistance are in the system?</p> <p>b. What is the average number of requests that will be waiting for service?</p> <p>c. What is the average waiting time in minutes before service begins?</p> <p>d. What is the average time at the reference desk in minutes (waiting time plus service time)?</p> <p>e. What is the probability that a new arrival has to wait for service?</p>	<b>6</b>	<b>Level 3</b>	<b>CO3</b>													
	<b>c.</b>	<p>For the following game, find the Nash equilibrium.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="2" rowspan="2"></td> <td colspan="2">Player B</td> </tr> <tr> <td>L</td> <td>R</td> </tr> <tr> <td rowspan="2">Player A</td> <td>U</td> <td>(3,9)</td> <td>(1,8)</td> </tr> <tr> <td>D</td> <td>(0,0)</td> <td>(2,1)</td> </tr> </table>			Player B		L	R	Player A	U	(3,9)	(1,8)	D	(0,0)	(2,1)	<b>6</b>	<b>Level 3</b>	<b>CO3</b>
		Player B																
		L	R															
Player A	U	(3,9)	(1,8)															
	D	(0,0)	(2,1)															
<b>Q. 5</b>		Answer <b>Any two</b> of the following.																
	<b>a.</b>	What is Prisoner's Dilemma? Explain with an example.	<b>6</b>	<b>Level 2</b>	<b>CO2</b>													
	<b>b.</b>	Explain the EOQ and EPQ Inventory, Models	<b>6</b>	<b>Level 2</b>	<b>CO2</b>													
	<b>c.</b>	Suggest different areas of applications for 'Travelling Salesman Problems-Indexing Method' and 'Assignment Type Problems'	<b>6</b>	<b>Level 2</b>	<b>CO2</b>													
<b>Q. 6</b>		Answer <b>Any two</b> of the following.																
	<b>a.</b>	What is Sensitivity Analysis in Linear Programming? Explain its significance.	<b>6</b>	<b>Level 1</b>	<b>CO1</b>													
	<b>b.</b>	Explain the meaning of 'Shadow Price' and 'Reduced Cost' in a sensitivity analysis	<b>6</b>	<b>Level 1</b>	<b>CO1</b>													
	<b>c.</b>	What are the steps to the solution of an LP problem by graphical method?	<b>6</b>	<b>Level 1</b>	<b>CO1</b>													