#  <br> viech <br> Name: <br> Roll No. <br> $\qquad$ N -s.inn <br> Invigilator's Signature : <br> $\qquad$ <br> CS/M.Phil (MGMT.)/SEM-1/MKT-FIN-HRM-001/2010 2010 ADVANCED MANAGEMENT RESEARCH TECHNIQUES 

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Note : Graph sheet(s) will be supplied by the institution.
Answer any five questions. $\quad 5 \times 14=70$

1. An admissions tutor is analysing (with help from the Management School) applications from potential students for Graduate courses at an Intergrated Collage (IC). A potential student can (for the purpose of preliminary analysis) be regarded as being in one of the five possible states :
i) State 1 : has not applied to IC
ii) Sate 2 : has applied to IC
iii) State 3 : has applied to IC and has been interviewed
iv) State 4 : has applied to IC and has been rejected
v) State 5 : has applied to IC and has been made an offer of a place.

At the start of the year (month 1 in the year) all potential students are in State 1.

A review of admissions statistics has identified the following transition matrix for the probability of moving between states of each month :

| From | To | 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1 | $0 \cdot 95$ | $0 \cdot 05$ | 0 | 0 | 0 |
|  | 2 | 0 | $0 \cdot 2$ | $0 \cdot 7$ | 0 | $0 \cdot 1$ |
|  | 3 | 0 | 0 | $0 \cdot 3$ | $0 \cdot 6$ | $0 \cdot 1$ |
|  | 4 | 0 | 0 | 0 | 1 | 0 |
|  | 5 | 0 | 0 | 0 | 0 | 1 |

a) What percentage of potential students will have been offered places after 3 months have elapsed?
b) Is it possible to work out a long-run system state or not and why?
2. Consider the following variables for a Paper Factory (in Metric and Non-metric scale)

X1-Customer Type, X2-Industry Type, X3-Firm Size, X4-Region, X5-Distribution System, X6-Product Quality, X7-E-Commerce Activities, X8-Technical Support, X9-Complaint Resolution, X10-Advertising, X11-Product Line, X12-Sales force Image, X13-Competitive Pricing, X14- Warranty \& Claims, X15-New Products, X16-Order \& Billing, X17-Price Flexibility, X18-Delivery Speed, X19-Satisfaction, X20-Likely to Recommend, X21-Likely to Purchase, X22-Purchase Level

a) Interpret the Tables in respect of the relevant variables enumerated above.
b) Explain the steps for selecting this company by the type of the industry as given in Centroid Matrix with the help of a hypothetical example of your choice. $10+4$

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3. Consider the data and variables as listed in question 2 above and see the outputs below obtained by using SPSS package and answer the following :
a) Interpret the Tables as given below.
b) Name the factors relevant to the variables as listed.

$$
8+6
$$




Extraction method : Principal component analysis.

Rotation method : Varimax with Kaiser normalization.
4. a) What are the basic stages in the application of cluster analysis?
b) What is the purpose of cluster analysis and when should it be used instead of factor analysis?
c) How does a researcher decide the number of clusters to have in a solution?
$4+8+2$
5. A company is considering whether it should tender for two contracts (MS1 \& MS2) for the supply of certain components. The company has three options :
a) tender for MS 1 only
b) tender for MS2 only
c) tender for both MS1 and MS2.

If tenders are to be submitted the company will incur additional costs. These costs will have to be entirely recovered from the contract price. The risk is that if a tender is unsuccessful the company will make a loss. The cost of tendering for contract MS1 only is Rs. 50,000. The component supply cost if the tender is successful would be Rs. 18,000.
The cost of tendering for contract MS2 only is Rs. 14,000 . The component supply cost if the tender is successful would be Rs. 12,000.

The cost of tendering both contract MS1 and contract MS2 is Rs. 55,000 . The component supply cost if the tender is successful would be Rs. 24,000.
For each contract, possible tender prices have been determined. In addition, subjective assessments have been made of the probability of getting the contract with a particular tender price as shown below. Note here that the company can only submit one tender and cannot, for example, submit two tenders (at different prices) for the same contract.

| Option | Possible tender price (Rs.) | Probability of getting contract |
| :--- | :---: | :---: |
| MS1 only | $1,30,000$ | $0 \cdot 29$ |
|  | $1,15,000$ | $0 \cdot 85$ |
| MS2 only | 70,000 | $0 \cdot 15$ |
|  | 65,000 | $0 \cdot 80$ |
|  | 60,000 | $0 \cdot 95$ |
|  | $1,90,000$ | $0 \cdot 05$ |

In the event that the company tenders for the both MS1 and MS2 it will either win both contracts (at the price shown above) or no contract at all.
i) What do you suggest the company should do and why?
ii) What are the downside and the upside of the suggested course of action?
iii) A consultant has approached company with an offer that in return for Rs. 20,000 in cash he will ensure that if you tender Rs. 60,000 for contract MS2 only your tender is guaranteed to be successful. Should the offer be accepted or not and why?
6. a) Solve the following non-linear programming problem graphically :

$$
\begin{array}{ll}
\text { Minimize } & \pi=(x-4)^{2}+(y-4)^{2} \\
\text { subject to } & 2 x+3 y \geq 6 \\
& -3 x-2 y \geq-12 \\
& x, y \geq 0
\end{array}
$$

b) A student is preparing for exams in two subjects. He estimates that the grades he will obtain in each subject, as a function of the amount of time spent working on them are

$$
\begin{aligned}
& g_{1}=20+20 \sqrt{t_{1}} \\
& g_{2}=-80+3 t_{2}
\end{aligned}
$$

where $g_{i}$ is the grade in subject $i$ and $t_{i}$ is the number of hours per week spent in studying for subject $i, i=1,2$. He wishes to maximize his grade average $\left(g_{1}+g_{2}\right) / 2$. He cannot spend in total more than 60 hours studying in the week. Find the optimal values of $t_{1}$ and $t_{2}$ and discuss the characteristics of the solution. Why is this essentially an economic problem ?
c) Discuss how non-linearities can arise either in the objective function or in the constraint conditions.

$$
4+7+3
$$

7. a) Define a time series. Mention application areas of time series.
b) Define a stationary process. When is a process said to be weakly stationary?
c) What are auto-regressive process ? Show that for a stationary AR (1) process,
$\operatorname{Var}\left(Y_{t}\right)=\frac{\sigma_{\epsilon}^{2}}{1-\phi^{2}}$
where the symbols have their usual significance.
d) Define a moving average process of order 1 . How can the definition be extended to an MA (q) process ?

$$
3+3+5+3
$$

8. a) Consider the problem :

Minimize $\quad\left(x^{2}+y^{2}+z^{2}\right)$
subject to $x+y+z=1$
i) Write down the Lagrangean for this problem and find the only point ( $x, y, z$ ) that satisfies the necessary conditions.
ii) Give a geometric argument for the existence of a solution. Has the corresponding maximization problem any solution?
b) You have chance to invest your money in either a $75 \%$ bond that sells at face value or an aggressive growth stock that pays only $1 \%$ dividend. If inflation is feared, the interest rate will go up to $8 \%$, in which case the principal value 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 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 unchanged, the stock value will go up by $8 \%$ and the bond principal value will remain the same. Economists estimate a $20 \%$ chance that inflation will rise and $15 \%$ that recession will set in. Assume that you are basing your investment decision on next year's economic conditions.
i) Represent the problem as a decision tree.
ii) Would you invest in stock or bonds?

