Use separate answer script for each group

Ph.D. Course Work Examination, 2024

Paper-1: Research Methodology and Techniques

Questions are of value as indicated in the margin
Notations used are of usual meaning

Time: 4 Hours | Full Marks: 80

Group-A [Common to all Science subjects]: LaTeX [Marks: 20]

*Answer **any two** questions*

1.a) Write the source code of the following equation:

$$\sin\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos\theta}{2}}$$

b) Differentiate between \hline{} and \cline{} commands?
c) Briefly explain the purpose of the BibTeX file (.bib).
d) Briefly explain the use of \label{} and \ref{} commands with an example.

$2+2+3+3=10$

2.a) Write down the source code of the following table:

Company	Model	Processor	
		i5	i7
DELL	Vostro	50,000	65,000
	Inspiron	60,000	75,000
HP	Pavilion	55,000	65,000
	EliteBook	75,000	95,000

Table 1: Hypothetical price of different laptop models

b) How do you add extra horizontal space in math mode? What is the use of \mathrm{} command?
c) Write the names of two image formats for each vector and raster graphics.
d) Differentiate between *tabular* and *table* environments.

$4+2+2+2=10$

3.a) Write down the output of the following source code:

```
$\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}$
```

b) What are the uses of '\,' and '\@' for spacing?
c) Write the syntax of the ordered list structure environment. What is the use of \includegraphics{} command?
d) Write the source code of a sample frame with the beamer documentclass.

$2+2+3+3=10$

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Ph. D Coursework Examination 2024
Computer and System Sciences
Paper – PCS-4.1
[Research Methodology and Techniques (Group – B)]

Time: Four hours **Full marks: 60**

Group – B[Marks 60]

Questions are of values as indicated in the margin
*Answer any **three** questions*

1. What is data pre-processing? Why it is important? Discuss the steps of pre processing. Compare and contrast – (i) supervised learning, (ii) unsupervised learning and (iii) reinforcement learning.

$3 + 3 + 5 + 9 = 20$

2. Explain why in IoT physical objects need to interact and share information seamlessly. Describe the three main communication models in IoT: Machine-to-Machine (M2M) Communication, Device-to-Device (D2D) Communication, and Device-to-Machine (D2M) Communication. Discuss the significance of "seamless device integration" within an IoT network as one of its key objectives.

$5 + (3 + 3 + 3) + 6 = 20$

3. Define the term "Interoperability" in the context of the Internet of Things (IoT) and explain why it is a crucial objective for IoT systems. List and briefly describe at least five different types of heterogeneity that pose challenges to achieving interoperability in IoT. Explain the three main types of interoperability: User, Syntactic, and Semantic.

$(4 + 3) + 10 + 3 = 20$

4. Justify the significance of a conference in research work. What are the different stages associated to the publication of an article in a conference proceeding? Explain –(i) google scholar citation, (ii) h-index and (iii) i-10 index of an author.

$5 + 9 + 6 = 20$

5. What is indexing of a Journal? Explain the importance of Impact Factor of a Journal. Discuss the publication cycle in relation to the publication of an article in a Journal. How is an Open Access journal different from a Close Access one?

$4 + 4 + 8 + 4 = 20$

6. Discuss OLAP and write down the operations. 5x4=20

a) Roll-Up
b) Drill-Down
c) Slice
d) Pivot

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Ph. D Coursework Examination 2024
Computer and System Sciences
Paper – PCS-4.3
[Data Mining]

Time: Four hours **Full marks: 80**

Questions are of values as indicated in the margin
*Answer any **four** questions*

1. Explain the concept of backpropagation. How does it work in a multi-layer Artificial Neural Network (ANN)? What is overfitting and under fitting in an ANN? How can one address these issues?

$5 + 5 + (3 + 3) + 4 = 20$

2. Explain the working principle of a decision tree in respect of classification. How does one split data in decision tree? Can you suggest any alternative method to this conventional method?

$8 + 6 + 6 = 20$

3. a) Compare data warehouse and database.
   b) Discuss the effect of changing the value of K in K-NN algorithm.
   c) Discuss the different stages of data mining.

$6 + 6 + 8 = 20$

4. a) Write K-means algorithm. Analyze its time complexity.
   b) Execute this algorithm on the dataset: {2, 4, 10, 12, 3, 20, 30, 11, 25}.
   c) Distinguish between K-means clustering and hierarchical clustering.

$(5 + 2) + 6 + 7 = 20$

5. Consider the following transactional database:

Transaction ID	Items Purchased
T1	{milk, bread, butter}
T2	{bread, butter}
T3	{milk, bread}
T4	{milk, bread, butter}
T5	{milk, bread, eggs}

a) Let the minimum support be 30%. Indicate each possible candidate set by C_k, k=1,2,...,n. Now some candidates are pruned in each pruning step and the resulting frequent itemset is L_k. Compute all possible C_k and L_k.

b) Let the minimum support be 30% and the minimum confidence be 75%. Now show all association rules that can be constructed from the same transactional database.

$12 + 8 = 20$

6. What is curse of dimensionality problem? How to overcome the curse of dimensionality? Why do we perform data visualization?

$7 + 7 + 6 = 20$

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Ph. D Coursework Examination 2024
Computer and System Sciences
Paper – PCS-4.5
[Mobile Broadband Networks]

Time: Four hours **Full marks: 80**

Questions are of values as indicated in the margin
*Answer any **four** questions*

1. Explain the Underwater Acoustic Sensor Network. Explain the different algorithms for the localization of each node underwater.

   6 + 14 = 20

2. Explain the use of Universal Middleware Bridge (UMB) in the context of device interoperability. Elaborate with suitable diagram the key components of UMB.

   8 + 12 = 20

3. Discuss and differentiate Arduino Uno and Raspberry Pi board. Explain RFID in detail along with its type.

   20

4. Explain the types of actuators and interaction between two sensor-actuator pairs through an MCU (e.g. Arduino Uno). Explain why are drivers needed for certain types of actuators.

   15 + 5 = 20

5. Demonstrate in detail about Software Defined Networking. Illustrate in detail about the architecture of SDN.

   10 + 10 = 20

6. Explain WSN coverage and connectivity. Explain and categorize the Coverage Problem and elaborate about its maintenance.

   10 + 10 = 20

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Ph.D. Coursework Examination, 2024
Department of Computer and System Sciences
Course: PCS-3.1 (Research Methodologies and Techniques)

Time: 4 hours **Full Marks: 80**

Answer Group-A *and all other groups*

Group B

*Answer **any four** questions*

1. How do you know if a journal is indexed in Web of Science?
2. How do you find the suitable journal list for a specific abstract and title?
3. Write the full form of ESCI, SCI, and SCIE.
4. Name some reference manager softwares?
5. Which is better ISI or Scopus?
6. Suppose your h-index in Google scholar is 8. What does it mean?
7. What do you mean by APA and MLA format? [5× 4 = 20]

Group C

*Answer **any four** questions*

1. What is difference between SCI and Scopus?
2. Is Web of Science same as SCI?
3. What is meant by SCI Journal?
4. How can you publish your paper in Scopus journal?
5. What Scopus stands for?
6. What is Scopus ranking?
7. What do you mean by Q1, Q2, Q3 and Q4 journals? [5 × 4 = 20]

Group D

*Answer **any two** questions*

1. Briefly discuss the publication cycle of an article in a journal.
2. What are different types of books?
3. a) What do you mean by Research Methodology?
   b) Explain the steps in research process with the help of flow chart.
4. a)What are the different types of methods of eliminating uncertainty in marketing decision making?
   b)Differentiate between scientific and non-scientific methods of research. [10× 2 = 20]

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