2017-18
M.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
SOFTWARE ENGINEERING-II
CO-603

Maximum Marks: 60  Credits: 04  Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No  Question  M.M.
1.  Give very brief answers to the following:
   i)  Why does Legacy Software demand change?
   ii) What are various Umbrella activities in a software process framework?
   iii) Write Hooker’s General Principles for Software Engineering.
   iv)  List Evolutionary Software Process Models. What is Unified Process?
   v)   What is the Manifesto for Agile Software Development given by Beck?
       List the various Agile Methods proposed in recent times.

   OR

1’(a)  Define Agility with respect to software engineering. Briefly describe the criteria for
       choosing agile development over plan driven approach.

1’(b)  Explain the Extreme Programming method of agile software development. What is
       pair programming and what are its advantages?

2(a)  What are Web Apps? List and explain their characteristics.

   OR

2(a’)  List and explain phases of Scrum? Clearly describe the sprint cycle.

2(b)  What are the phases of Requirements Engineering? With the help of a suitable
       example list and explain the various components of Requirements Elicitation
       phase.

3(a)  Explain the various types of system model used for software development.

3(b)  Why Software Configuration Management is an important aspect of software
       engineering? With the help of a flowchart explain the change control process.

Contd... 2.
4. (a) What is a software risk? List the various categories of software risks. What do you understand by RMMM? [07]

OR

4 (a') A software project is under the threat of the following risks:

i) The size of software is wrongly estimated to be 150 KLOC less than the actual software. The risk probability is 70% and the cost per LOC is Rs.100.00

ii) Only 30% of the initially planned 60 components would be reused. The average size of each component is 20 KLOC and the risk probability is 75%.

Determine the overall Risk Exposure to the software project.

4(b) What is the difference between forward engineering and software re-engineering? [08]
Explain the complete process of software re-engineering with suitable diagram.
2017-18
M.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER SCIENCE & ENGINEERING
OBJECT ORIENTED ANALYSIS & DESIGN
CO604

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question  M.M.
1(a)  Construct class diagram based upon following description – After having qualified entrance examination for a course in a university, newly admitted students go through admission process. First they fill up admission card and submit it at Verification Counter. Next they move to Academic Counter where they are assigned Faculty Number, Enrolment Number and Hostel. Finally they move to Fee Counter and admission formality is over after depositing fee. [7.5]

1(b)  What is Sequence in UML? Give a realistic example of class diagram containing Sequence. Differentiate between Ordered and Sequence in UML. [7.5]

OR

1′(a)  Construct class diagram based upon following description – A cricket tournament is about to take place in which few teams will participate. Tournament will begin with league matches to be followed by semi-final and final match. A cricket team consists of eleven players led by a captain. Any player may play any role in the team such as batsman, bowler, wicketkeeper etc. [7.5]

1′(b)  What is Scope of a feature in class? Take realistic example of class diagram showing different scopes. [7.5]

2(a)  Construct state diagram for a lift installed in a high rise apartment. Make suitable assumptions wherever required and list them. [7.5]

2(b)  What is One-Shot state diagram? Take suitable example to explain. [7.5]
2'(a)  How is concurrency within an object represented in state diagram? Take suitable example to explain.

2'(b)  Construct state diagram for a Boiler which has a valve opening through which it supplies steam. The Boiler is also equipped with a release valve which gets opened in the event of high pressure and closes when pressure normalises. The Boiler is also equipped with water sensor which puts off the furnace if there is no water in Boiler.

3(a)  Construct a detailed Use Case diagram for ATM machine. Relate use cases with appropriate relation such as include, extend and generalization. [7.5]

3(b)  How are passive and transient objects represented in sequence diagram? Show them by using realistic examples. [7.5]

4(a)  What is data dictionary? Give an example of data dictionary. [7.5]

4(b)  Describe steps for constructing application interaction model. [7.5]
Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question                              M.M.
1(a)  Attempt any two parts.                [15]
1(b)  Briefly explain the measure called Information Gain, which is used for [7.5]
      attribute selection in the decision tree based classification. For the data
      provided in Table 1, select the best splitting attribute using Information Gain.

1(b)  What is sequential pattern mining? List different applications of sequential [7.5]
      pattern mining. Discuss the challenges on sequential pattern mining.
1(c)  Discuss the neural network based classification. What are the advantages and [7.5]
      disadvantages of using neural networks for classification?

2(a)  Attempt any two parts.                [15]
2(b)  Write down the Apriori algorithm for association rule mining. For the [7.5]
      following transaction database, use the Apriori algorithm to find all the
      frequent item-sets with the minimum support 0.4.

TID  Items Bought
T1   \{C,A,D,B\}
T2   \{D,A,C,B,E\}
T3   \{C,A,B,E\}
T4   \{B,A,D\}
T5   \{F,A,C,B,E\}
2(c)  Write down the K-means algorithm for clustering. Compare the complexities [7.5]
      of serial and parallel K-means algorithm.

2(c)  What is privacy preserving data mining? Discuss briefly the different issues [7.5]
      and tools of privacy preserving data mining.

3(a)  Attempt any two parts.                [15]
3(b)  Discuss the importance of Data preprocessing in Web usage mining. Draw a [7.5]
      block diagram to illustrate Web usage mining architecture and discuss each
      module briefly.
3(b)  Discuss the HITS algorithm. List the systems based on HITS algorithm. [7.5]
      What are the limitations of HITS algorithm?
3(c) What do you mean by Content Based Image Retrieval (CBIR)? List different applications of CBIR. Discuss different signature based approaches used for image retrieval.

4 Attempt any two parts.

4(a) What do you mean by a Web crawler? Write down the basic Web crawler algorithm. List different research topics in Web crawling.

4(b) What is Big Data? Discuss different Vs of Big Data.

4(c) Consider the set of documents and the query Q as given in Table 2 with the frequency of the occurrence of the words therein. Compute the similarity of these documents with the query Q using vector space model with TFIDF weighting. Finally, rank the documents in order of their similarity to the query Q.

Table 1

<table>
<thead>
<tr>
<th>age</th>
<th>income</th>
<th>student</th>
<th>credit_rating</th>
<th>buys_computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=30</td>
<td>high</td>
<td>yes</td>
<td>fair</td>
<td>yes</td>
</tr>
<tr>
<td>&lt;=30</td>
<td>low</td>
<td>yes</td>
<td>excellent</td>
<td>yes</td>
</tr>
<tr>
<td>31...40</td>
<td>high</td>
<td>no</td>
<td>fair</td>
<td>yes</td>
</tr>
<tr>
<td>&gt;40</td>
<td>medium</td>
<td>no</td>
<td>excellent</td>
<td>yes</td>
</tr>
<tr>
<td>&gt;40</td>
<td>low</td>
<td>no</td>
<td>fair</td>
<td>no</td>
</tr>
<tr>
<td>31...40</td>
<td>low</td>
<td>no</td>
<td>excellent</td>
<td>no</td>
</tr>
<tr>
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<td>low</td>
<td>no</td>
<td>excellent</td>
<td>yes</td>
</tr>
<tr>
<td>&lt;=30</td>
<td>medium</td>
<td>no</td>
<td>fair</td>
<td>no</td>
</tr>
<tr>
<td>&lt;=30</td>
<td>low</td>
<td>yes</td>
<td>excellent</td>
<td>yes</td>
</tr>
<tr>
<td>&gt;40</td>
<td>medium</td>
<td>no</td>
<td>excellent</td>
<td>yes</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Car</th>
<th>Jeep</th>
<th>Bike</th>
<th>Cat</th>
<th>Rat</th>
<th>Ant</th>
<th>Snake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doc 1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Doc 2</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Doc 3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Doc 4</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Doc 5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Doc 6</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Doc 7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Doc 8</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Q</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
2017-18  
M.TECH. (WINTER SEMESTER) EXAMINATION  
COMPUTER ENGINEERING  
MODERN ARTIFICIAL INTELLIGENCE  
CO - 621  

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours  

Answer all the questions. Assume suitable data if missing.  
Notations used have their usual meaning.

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Questions</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (a)</td>
<td>What do you think led to the study of Artificial Intelligence (AI)? Which fields of study particularly fed into it? Give one simple definition of Artificial Intelligence.</td>
<td>[05]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Why are PROLOG and LISP well suited to Artificial Intelligence research? Do you think languages such as C++, Java, and Python could also be used for such research? Explain.</td>
<td>[05]</td>
</tr>
<tr>
<td>1(c)</td>
<td>How do you choose a good heuristic? Which parameters should be considered while choosing a heuristic? Describe a heuristic that you may choose for solving 8-puzzle problem.</td>
<td>[05]</td>
</tr>
<tr>
<td>2</td>
<td>Answer any two of the following:</td>
<td>[7.5x2]</td>
</tr>
<tr>
<td></td>
<td>(a) Explain Depth First Iterative Deepening (DFID) search. What is the time complexity of DFID? Is it optimal and complete?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Design a suitable representation and draw search tree for the following problem:</td>
<td></td>
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<tr>
<td></td>
<td>A farmer is on one side of a river and wishes to cross the river with a wolf, a chicken, and a bag of grain. He can take only one item at a time in his boat with him. He can’t leave the chicken alone with the grain, or it will eat the grain and he can’t leave the wolf alone with the chicken, or the wolf will eat the chicken. How does he get all three safely across to the other side of the river?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) i. Show that a formula ( \alpha : (A \land B) \land (B \rightarrow \neg A) ) is unsatisfiable using the tableau method.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Convert the following formula into its equivalent Conjunctive Normal Form (CNF) representation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( (\neg A \rightarrow B) \land (A \rightarrow D) \land (C \lor B) )</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Answer any two of the following:</td>
<td>[7.5x2]</td>
</tr>
<tr>
<td></td>
<td>(a) Explain Natural Deduction System (NDS). Based on NDS prove the following theorem.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>theorem : from ( A \land B ) infer ( A \land (B \lor C) )</td>
<td></td>
</tr>
</tbody>
</table>
(b) What is the difference between supervised learning and unsupervised learning? Describe a model of an artificial neuron. Describe at least three activation functions that can be used in artificial neurons.

(c) Describe Hopfield network. Compute the weight matrix for a Hopfield network with four nodes for the following three training input vectors. Also check the stability of the network.

\[
X_1 = \begin{bmatrix}
1 \\
-1 \\
-1 \\
1
\end{bmatrix}, \quad X_2 = \begin{bmatrix}
1 \\
1 \\
-1 \\
1
\end{bmatrix}, \quad X_3 = \begin{bmatrix}
-1 \\
1 \\
1 \\
-1
\end{bmatrix}
\]

4 Answer any two of the following:

(a) With an example, explain a simple learning algorithm that uses the general-to-specific ordering of hypotheses to search the hypothesis space for a suitable hypothesis.

(b) (i) Let a fuzzy set \( A \) be defined over a Universe \( X \). Prove the following (graphically or otherwise).

\[
A \cap \sim A \neq \emptyset \\
A \cup \sim A \neq X
\]

(ii) Briefly explain Genetic Algorithm (GA). What are the advantages and disadvantages of Genetic Algorithm?

(c) Explain Certainty Factor (CF), Measure of Belief (MB), and Measure of Disbelief (MD) for measuring uncertainty. Suppose by observing evidences \( E_1 \) and \( E_2 \), we confirm our belief in hypothesis \( H \) with \( MB(H, E_1) = 0.7 \) and \( MD(H, E_1) = 0.2 \), \( MB(H, E_2) = 0.4 \), and \( MD(H, E_2) = 0.1 \). Then, compute the following:

(i) \( CF(H, E_1) \)
(ii) \( MB(H, E_1 \text{ and } E_2) \)
(iii) \( MD(H, E_1 \text{ and } E_2) \)
(iv) \( CF(H, E_1 \text{ and } E_2) \)
Maximum Marks: 60
Credits: 04
Duration: Two Hours

Attempt all questions
Abbreviations and symbols have their usual meanings.

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<tr>
<td>1(a)</td>
<td>Define subjective brightness and brightness adaptation.</td>
<td>[03]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Describe the fundamental steps in image processing?</td>
<td>[06]</td>
</tr>
<tr>
<td>1(c)</td>
<td>Explain the structure of the human eye.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(a)</td>
<td>What is meant by correlation and convolution?</td>
<td>[04]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Give the mask for high boost filtering?</td>
<td>[03]</td>
</tr>
<tr>
<td>2(c)</td>
<td>Discuss in detail Histogram Processing (Equalization and Specification)</td>
<td>[08]</td>
</tr>
<tr>
<td>3(a)</td>
<td>What are applications of image transform?</td>
<td>[03]</td>
</tr>
<tr>
<td>3(b)</td>
<td>What is Pseudocolor Image Processing? Discuss its application in intensity slicing and intensity to color transformations</td>
<td>[06]</td>
</tr>
<tr>
<td>3(c)</td>
<td>Explain the Geometrical Transformation used in image restoration.</td>
<td>[06]</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
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<tbody>
<tr>
<td>3'(a)</td>
<td>Differentiate between linear and non-linear spatial filter.</td>
<td>[03]</td>
</tr>
<tr>
<td>3'(b)</td>
<td>What are different types of discontinuity in digital images? How are these discontinuities discovered in digital images?</td>
<td>[06]</td>
</tr>
<tr>
<td>3'(c)</td>
<td>Consider the simple function $y = \begin{cases} x^2, &amp; 0 \leq x \leq 1 \ 0, &amp; otherwise \end{cases}$ using Haar wavelets and a starting scale $j_0 = 0$. Compute approximation and difference coefficients for the function $y$, where Haar scaling function is defined as</td>
<td>[06]</td>
</tr>
</tbody>
</table>
\[ \varphi(x) = \begin{cases} 1, & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases} \]

and Haar wavelet is defined as

\[ \Psi(x) = \begin{cases} 1 & 0 \leq x \leq 0.5 \\ -1 & 0.5 \leq x \leq 1 \\ 0 & \text{elsewhere} \end{cases} \]

4(a) Define interpixel, coding and psycho visual redundancy?

4(b) Let \( A \) denote the set shown in the Figure 1. Refer to the structuring elements shown (the black dots denote the origin). Sketch the result of the following morphological operations.

\[
\begin{align*}
&i. \quad (A \ominus B^1) \oplus B^2 \\
&ii. \quad (A \oplus B^2) \ominus B^1
\end{align*}
\]

4(c) A source emits seven symbols A,B,C,D,E,F and G with a probability \( \{0.2, 0.1, 0.2, 0.05, 0.3, 0.05, 0.1\} \) respectively. Find average length and entropy of Huffman codes for the above symbols?

OR

4'(a) Erosion and dilation are duals of each other. Prove that \((A \ominus B)^C = A^c \oplus B\) holds

4'(b) What is JPEG? What are the different steps involved in JPEG?

4'(c) Define region growing segmentation technique? Also, specify the steps involved in region merging and splitting.

Figure 1