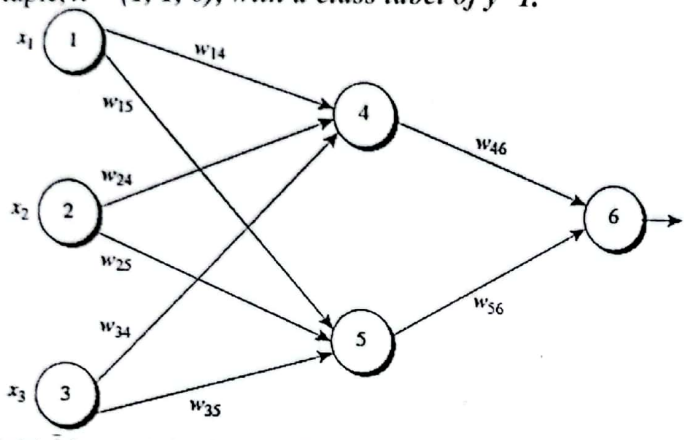
Institute of Information Technology
Jahangirnagar University
4th Year 1st Semester B.Sc (Hons.) Final Examination, 2021
Subject: Information Technology

Time: 3 Hours | IT4101: Course Title **Artificial Intelligence and Neural network** | Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.
**(Sequence must be maintained in answering each of the questions)**

1. Figure shows a multilayer Feed-Forward neural network. Let the learning rate be **0.9**. The initial weight and bias values of the network are given in Table, along with the first training tuple, ***x = (1, 1, 0), with a class label of y=1.*** [4x3=12]




**Initial Input, Weight, and Bias Values**

| $x_1$ | $x_2$ | $x_3$ | $w_{14}$ | $w_{15}$ | $w_{24}$ | $w_{25}$ | $w_{34}$ | $w_{35}$ | $w_{46}$ | $w_{56}$ | $\theta_4$ | $\theta_5$ | $\theta_6$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0.2 | −0.3 | 0.4 | 0.4 | −0.5 | 0.4 | −0.3 | −0.2 | −0.4 | 0.3 | 0.2 |

Find out the following:
**(a)** Net Input and Output **(b)** Error at Each Node **(c)** Weight and **(d)** Bias Updating

2. **a.** Write short notes on cross-validation. [2]

**b.** What is Bootstrapping? What is the significance of 0.632 bootstrapping technique and why it is so called? [4]

**c.** The data tuples of table are sorted by decreasing probability value, as returned by a classifier. For each tuple, compute the values for the number of true positives (*TP*), false positives (*FP*), true negatives (*TN*), and false negatives (*FN*). Compute the true positive rate (*TPR*) and false positive rate (*FPR*). Plot the ROC curve for the data. [6]

| Tuple # | Class | Probability |
|---|---|---|
| 1 | P | 0.95 |
| 2 | N | 0.85 |
| 3 | P | 0.78 |
| 4 | P | 0.66 |
| 5 | N | 0.60 |
| 6 | P | 0.55 |
| 7 | N | 0.53 |
| 8 | N | 0.52 |
| 9 | N | 0.51 |
| 10 | P | 0.40 |

3. **a.** Define artificial intelligence (AI). Explain all four approaches of AI. [3]

**b.** What do you mean by supervised and unsupervised learning? Differentiate between them. [3]

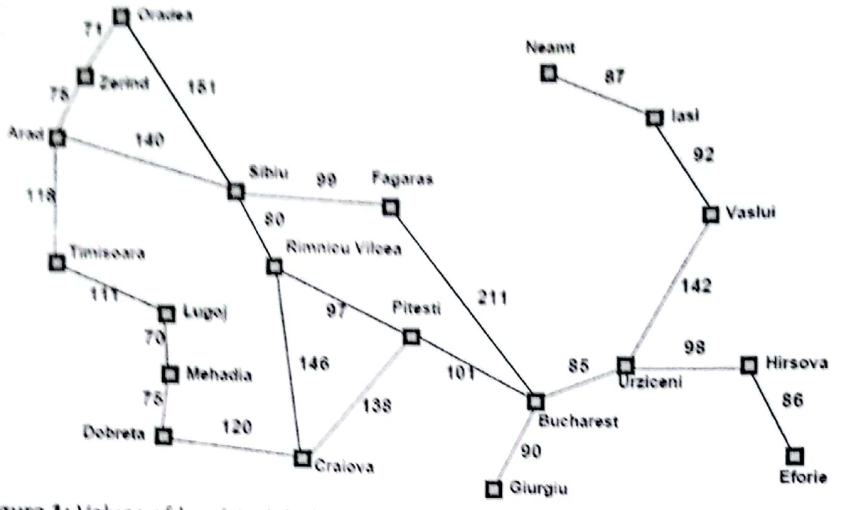
**c.** Define the terms: agent, agent function. [2]

d. How agents interact with environments through sensors and actuators? Use a vacuum-cleaner world with just two locations to explain those interactions.

4. [3x2=6]

a. Explain Min-Max algorithm and Alpha –beta pruning.

b. Use Figure:1 to find the way from 'Zerind' to 'Bucharest' using A* search. Show the stages clearly. [6]




Straight-line dista to Bucharest

| |
|---|
| Arad |
| Bucharest |
| Craiova |
| Dobreta |
| Eforie |
| Fagaras |
| Giurgiu |
| Hirsova |
| Iasi |
| Lugoj |
| Mehadia |
| Neamt |
| Oradea |
| Pitesti |
| Rimnicu Vilcea |
| Sibiu |
| Timisoara |
| Urziceni |
| Vaslui |
| Zerind |

**Figure 1:** Values of $h_{SLD}$ (straight line distances) to Bucharest from other cities.

5. a. How does the KNN algorithm work? How do we choose the factor K? [4]

b. We have a data from the questionnaires survey and objective testing with two attributes (acid durability and strength) to classify whether a special paper tissue is good or not. [8]

| Acid Durability (seconds) | Strength (kg/square meter) | Classification |
|---|---|---|
| 7 | 7 | Bad |
| 7 | 4 | Bad |
| 3 | 4 | Good |
| 1 | 4 | Good |

Now the factory produces a new paper tissue that pass laboratory test with Acid durability, 3 and strength, 7. Without another expensive survey, can you guess what the classification of this new tissue is?

6. a. What is meant by problem solving agent? Briefly explain goal formulation and problem formulation. [3]

b. What an agent-design assumes its environment is, if it does not have any idea of it? [1]

c. Give some real-life example of unsupervised machine learning is being used now-a-days. [2]

d. Write short notes on: [3x2=6]

I. 8-queens problem
II. Airline travel problem
III. The 8-puzzle

7. a. What will be the final state of vacuum problem if it is sensor less? Explain with appropriate figure. [4]

b. What are three distinct problem types lead by partial environment information? [2]

c. What is meant by heuristic search strategy? What is the significance of heuristic function? [2]

d. Explain greedy best-first search. What are the properties of greedy best-first search? [4]

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Time: 3 Hours | IT4103: Telecommunication Systems | Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1. a) Every subscriber in the world is identified by a number, which is geographically tied to a physical location. Explain how. 3
   b) "Tandem switch does not connect directly to telephones; instead, it connects to other class-4 switches and to class-5 telephone switches". Is the statement always true? Show your logic. 3
   c) Define Busy hour, Grade of Service and FOUR-WIRE CIRCUIT 3
   d) To convey intelligence, a code was developed by Morse, consisting of three elements: a dot, a dash and a space. Explain in detail with an example about Morse Code which is used to convey intelligence over the Electrical telegraph. 3

2. a) Discuss the basis of switching system. 3
   b) What is the significance of sidetone in a telephone conversation? In the sidetone given in the textbook, it is desired that 10% of the microphone signal has heard as sidetone. If the number of turns in the coil $P = 200$, determine the number of turns in the coil $Q$ and the secondary winding in the carphone circuit. 3
   c) Estimate the bandwidth requirements of a single satellite that is to support 20 million telephone conversation simultaneously. 2
   d) What is subscriber Loop systems? List the types of Numbering Plans. Discuss the PSTN numbering and charging plans that is employed in Bangladesh. 4

3. a) If a communications system uses 16 symbols, how many bits does each symbol represent? If the same system has a symbol rate of 10 000 baud, what is the data rate? Would 16-QAM be more or less susceptible to noise than the 16-PSK? 3
   b) Draw and explain the Constellation diagram for Circular 16 QAM and Rectangular 16 QAM 3
   c) "A glass or plastic core is surrounded by a cladding of less dense glass or plastic." Explain why. 3
   d) Two types of antennas are used for microwave communications: the parabolic dish and the horn. Describe these two types of antennas. 3

4. a) Three causes of impairment in Telecommunication are attenuation, distortion, and noise. Explain two of them. 3
   b) Erlang's call blocking probability can be achieved from the recurrence relation. Derive the blocking probability from this relation. 3
   c) Offered traffic of a network of 6 trunks is 3.5 Erlang. How will the performance improve or degrade with the addition or removal of one trunk. 3
   d) A limited user network has a total of N users represented by Markovian chain of the following figure 1. Find the probability state $P_x$ and call blocking probability $B(N, \lambda, n)$ where $\lambda$ is the call arrival rate/min/user. 3

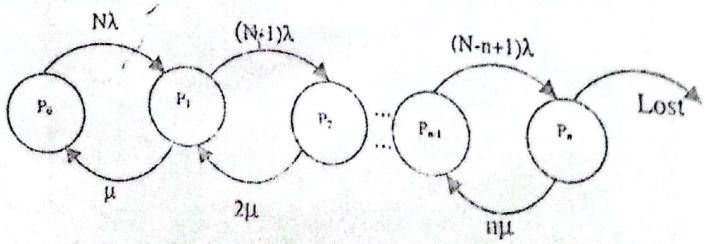


Figure 1

5. a) Mention the Advantages of an automatic switching system over manual exchanges. 3
   b) Explain the drive mechanism of a rotary switch.
   c) A typical step-by-step switching system has three major parts or stages. Explain these stages with the necessary diagram.
   d) Explain Dual Tone Multi-Frequency.

6. a) Draw a common control switching system and explain Event monitoring and call processing from four broad categories. 3
   b) Explain the Crossbar switch configuration. Three ways to reduce the number of switch contacts for a given number of subscribers. Explain one of them. 3
   c) Signal to quantization noise ratio (SQR) is a good measure of the performance of a PCM system transmitting speech. If $V_r$ is the r.m.s. value of the input signal and 1 ohm is the resistance level, then calculate SQR. Also, show the calculation of SQR for the full range sine wave if $V_m$ is the maximum amplitude. 3
   d) Explain Manchester and Differential Manchester scheme. 2

7. a) List the features of Stored Program Control (SPC) system. 2
   b) Distinguish between centralized SPC and distributed SPC. 5
   c) Explain the different operation modes in redundant configuration (e.g. dual processor) system. Use illustration to explain these operation modes. 3
   d) Given scenario
   A company has three components in a system and requires all three to be operational for 24 hours, Monday to Friday, as follows:
   Monday = No failure
   Tuesday = 5 AM to 7 AM
   Wednesday = No failure
   Thursday = 4 PM to 8 PM
   Friday = 8 AM to 11 AM
   Calculate the MTBF and MTTR.

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Time: 3 Hours | IT-4105: Management Information System | Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1. a) For MIS, what disciplines are closely considered as Systems analysis and design? Explain briefly. 4
   b) Make a comparison table of Manual Information Systems Vs. Computerized Information Systems. 4
   c) Data structures and algorithms are an efficient way of organizing and managing data for MIS, especially large datasets. How do you justify in case of Facebook? 4

2. a) What are the key management challenges involved in building, operating and maintaining information systems today? 3
   b) Identify and describe the three levels of the organizational hierarchy. Which types of information systems serve each level? 3
   c) Why is selecting computer hardware and software for the organization an important management decision? What management, organization, and technology issues should be considered when selecting computer hardware and software? 1+2
   d) Why are organizations trying to integrate their business processes? What are the four key enterprise applications for organization-wide process integration? 1+2

3. a) How to achieve Competitive Advantage of MIS by using Information Systems (considering an IT industry)? 4
   b) In Pyramid diagram, what are relationship among structured, semi-structured and unstructured with Operational, Tactical, and Strategic Management Level respectively? 4
   c) Draw a sample UML diagram that shows users interacting with a point of a university management system. 4

4. a) What is meant by virtualization? How does virtualization help an organization to increase its performance? 1+3
   b) What are the advantages and disadvantages of cloud computing? 3
   c) What are the latest trends in green computing? What kind of impact are they having? 1+2
   d) Is a knowledge management system the same as an expert system? Explain. 2

5. a) Define E-Business, E-Commerce and M-Commerce with example. 4
   b) What are the different categories of E-Commerce business model? Explains with example and respective diagram. 4
   c) Outsourcing impact on company culture as well as the quality of work. How? 4

6. a) Assume you are a software developer. Explain how you compare a software with Agile Testing Quadrants. 4
   b) What are the main types of Agile metrics and how they can be effective for MIS? 4
   c) Scaled Agile Framework (SAFe) and Value Stream in SAFe are much correlated for designing MIS. Explain, when you apply SAFe. 4

7. a) Explain the different techniques and phases of Dynamic Software Development Method (DSDM). 4
   b) Make a comparison table between Feature Driven Development (FDD) and Lean Software Development. 4
   c) DevOps can help in scalability of a system. Justify your answer. 4

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Time: 3 Hours | IT4107: Parallel and Distributed System | Full Marks: 60

Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1. a) If you are planning to design a distributed system where the computers will be resided in different geographical locations what consequences you must be considered? 3
   b) How grid system differs from cluster system in distributed environment? Explain. 2
   c) Describe the challenges that any designer who is planning to design a distributed system must consider before start designing the system. 5
   How the traditional client-server model can be modified in distributed system? 2

2. a) An experimental file server is up 3/4 of the time and down 1/4 of the time, due to bugs. How many times does this file server have to be replicated to give an availability of at least 99%? 3
   b) i. Describe how connectionless communication between a client and a server proceeds when using sockets. and 3
   ii. Is a server that maintains a TCP/IP connection to a client stateful or state-less?
   c) Nodes A and B wish to time synchronize. The link from A to B takes 40ms, and the link from B to A takes 20ms but these numbers are not known to the computers. They synchronize using Cristian's algorithm in one round. Node A's time is 500 and Node B's time is 632. Node A starts the protocol. At the completion of the protocol what time does Node A believe it is? 4
   d) Briefly describe the roles of middleware in a distributed system? 2

3. a) i. Dependable systems are often required to provide a high degree of security. Why? 4
   ii. Consider the behavior of two machines in a distributed system. Both have clocks that are supposed to tick 1000 times per millisecond. One of them actually does, but the other ticks only 990 times per millisecond. If UTC updates come in once a minute, what is the maximum clock skew that will occur?
   b) What is called bully algorithm? What are the applications of bully algorithm in distributed system? 2
   c) **Scenario.** The Bully Algorithm solves the leader election problem in a synchronous system with process crashes and recoveries. Suppose the Bully Algorithm is used in an asynchronous system where processes may crash and may recover. Before the algorithm is executed, the system administrator determines the timeouts T and T` based on observed message and processing latencies over a short period of time. The algorithm is configured to use these selected timeouts. 4
   i. Describe an execution of the Bully algorithm (in this asynchronous system model with $N > 2$) that leads to more than one process declaring itself the leader. (N: nodes)
   d) What is stub? How are stubs generated? 2

4. a) Consider a URL as www.mail.yahoo.com/mail/inbox.html . A name resolver may resolve the name using either iterative or recursive way. Which one is better in your opinion? Justify why. 4
   b) Why global clock cannot be imposed in distributed system? What alternate solution Lamport provided regarding this problem? Explain. 4
   c) Make a brief comparison among mutual exclusion algorithms. 4

5. a)
   i. What is three-tiered client-server architecture?
   ii. Does it make sense to implement persistent asynchronous communication by means of RPCs?

   b) In this problem you are to compare reading a file using a single-threaded file server and a multithreaded server. It takes 15 msec to get a request for work, dispatch it, and do the rest of the necessary processing, assuming that the data needed are in a cache in main memory. If a disk operation is needed, as is the case one-third of the time, an additional 75 msec is required, during which time the thread sleeps. How many requests/sec can the server handle? 4
      i. If it is single threaded.
      ii. If it is multithreaded.

   c) Define heterogeneity and mention the characteristics of heterogeneity? 2

   d) Define load balancing in distributed systems? 2

6. a) i. Dependable systems are often required to provide a high degree of security, Why? 3
      iii. What is called software agents? Discuss the different types of software agents.

   b) Does using time stamping for concurrency control ensure serializability? Explain in your words. 3

   c) What is Flynn's Taxonomy? 2

   d) Explain Task and Data parallelism using appropriate examples. 4

7. a) Describe the binding agent mechanism for locating a server in case of remote procedure call. 4

   b) What are the differences between a local procedure call and a remote procedure call? 2

   c) Explain crash failure, Omission failure, and Timing failure with appropriate examples. 3

   d. Consider a distributed system consisting of four replicated servers. Each of the servers is available at any instant with a probability of 90%. If the system is designed so that the system can be operational if any one of the four servers is operational, what is the overall system availability? What if the system is designed such that all four servers have to be available for the entire system to be available? 3