Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination | **Fall 2021** | **4th Year 1st Semester**

Course Code: CSE 403 | **Course Title: Artificial Intelligence and Expert Systems** | **Credits: 3**

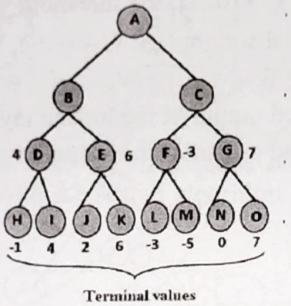
Full Marks: 150 | **Duration: 3 Hours**

Instructions:

1. There are **six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Programmable calculators are not allowed.

1. **a)** What do you mean by Zero Sum Game in Artificial Intelligence? Explain with necessary payoff matrix. **[5]**

b) Consider the following game tree. **Illustrate** the step by step pruning process with **graphical representations** using alpha beta pruning. Assume that the first player is the maximizing player. **[20]**



OR

a) Define crossover and mutation with example. **[5]**

b) Simulate one step of Genetic Algorithm (selection, crossover and mutation) for the following function. Represent "***x***" using 4 bits. Population size is 5. **[20]**

$f(x) = \{MAX(x^2): 0 <= x <= 15\}$ over $\{0, 1, \ldots, 15\}$

2. **a)** Explain the assumptions of Markov Model. **[5]**

b) Suppose the probability of being "gloomy" on Saturday is 0.6. The Probability Transition matrix is given below. Calculate the probability of being "not gloomy" on Monday? Draw the Markov Chain of the above scenario. **[20]**

Saturday	Next day	Probability
gloomy	gloomy	0.6
gloomy	not gloomy	0.4
not gloomy	gloomy	0.2
not gloomy	not gloomy	0.8

OR **a)** **Explain** query variable, evidence variable and hidden variable with example. **[5]**

b) A training dataset of a certain number of patient's information and the corresponding target variable **"Has Flu"** are given below. Convert the dataset into a Frequency Table. Create a Likelihood Table and calculate the posterior probability. Can the doctor d***etermine*** the status of the field **'Has Flu'** of a patient having *chills, fever,* and *strong headache* and *without running nose*? Use Naïve Bayes algorithm for classification. **[20]**

chills	running nose	headache	fever	Has Flu
y	n	mild	y	n
y	y	no	n	y
y	n	strong	y	y
n	y	mild	y	y
n	n	no	n	n
n	y	strong	y	y
n	y	strong	n	n
y	y	mild	y	y

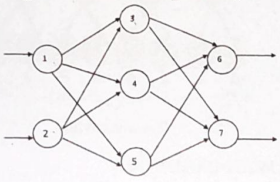
3. a) What does parameter optimization mean in machine learning model? Explain. **[5]**

b) How gradient decent control/determine the learning rate? Explain with an example. **[5]**

c) For the following Back-propagation Neural Network, assume that the feature vector, X = [1, 0] and desired output vector, Y = [0, 1], the threshold value $\theta_3 = \theta_4 = \theta_5 = 0.2$ and learning rate $\alpha = 0.1$. Consider the initial weights as: $W_{13} = 0.3$, $W_{14} = -0.5$, $W_{15} = W_{37} = 0.5$, $W_{23} = W_{24} = -0.2$, $W_{25} = 0.2$, $W_{36} = W_{56} = -0.4$, $W_{46} = W_{47} = -0.3$ and $W_{57} = 0.1$. **[15]**

i) Determine the predicted output of the hidden layer (neuron 3, 4 and 5)

ii) Determine the predicted output of the output layer (neuron 6, 7)



OR

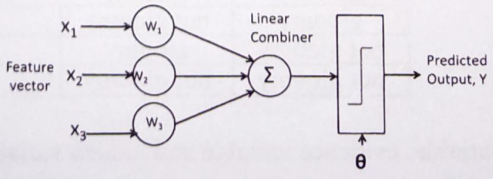
a) What is the difference between supervised learning and re-enforcement learning? **[5]**

b) What is the **"dying problem"** of *Relu* activation function? How *"Leaky Relu"* solved the dying problem of *Relu* activation function? **[5]**

c) For the following perceptron, the feature vector is X = [1 0 1] and the desired output is Y=1. Consider the threshold value $\theta = 0.2$, learning rate $\alpha = 0.1$, initial weights $W_1 = 0.2$, $W_2 = 0.1$, and $W_3 = 0.4$. **[15]**

i) **Measure** the predicted output and

ii) Calculate the updated weights (W_1, W_2 and W_3) after one iteration.



4. a) What are hedges in fuzzy logic? **Illustrate** how do hedges **modify** existing fuzzy sets? **[4+6]**

b) A group of 5 students of CSE department have been found to be **very good** programmer with membership values: [0.4, 0.5, 0.6, 0.7, 0.8] respectively. **Estimate** what would be membership values in order to represent them to be a: i) **good** programmer ii) **extremely good** programmer and iii) **more or less good** programmer. Also **show** the graphical representation for each of the students **[15]**

5. a) Express the following statements using predicate logic: **[15]**

i. Jack likes ice-cream.
ii. All red apples are delicious.
iii. Everyone likes someone.
iv. All black grapes are not sour.
v. Students who are industrious and disciplined will succeed.

b) Determine whether the following statement is satisfiable, contradictory, or valid? **[10]**

(P V Q) and (P V ~ Q) V P

6. a) What is admissible heuristic? Is the solution of the following 8-puzzle game has admissible heuristic? Why? Here, consider h_1 as number of misplaced tiles and h_2 as total Manhattan distance (city block distance). **[2+8]**

- $h_1(S) = ?$
- $h_2(S) = ?$

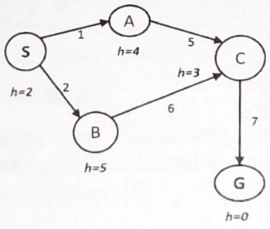
2	4	3
1	6	8
5		7

start

1	2	3
4		8
5	6	7

goal

b) Your target is to reach the goal node 'G' from start node 'S' with the cheapest cost. Simulate the following problem with A* search algorithm and show the shortest path with the fringe for each iteration. [15]



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Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination **Fall 2021** **4th Year 1st Semester**

Course Code: CSE 405 **Course Title: Operating Systems** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. What is deadlock? Define the conditions of deadlock situation. Explain deadlock situation using Resource Allocation graph. **[10]**

   b. What is the application of Banker's Algorithm? Explain Banker's Algorithm using an illustrative example. **[15]**

OR

   a. Name and define the methods for handling deadlocks. **[10]**

   b. Explain how one can prevent the occurrence of a deadlock by ensuring that at least one of four conditions cannot hold. **[15]**

2. a. Name and define different types of schedulers. What do you mean by preemptive and non-preemptive scheduling? **[10]**

   b. The following table indicates the processes and the burst time. Define and compare the Round-Robin and priority(preemptive) scheduling using the table:

Processes	Burst time(Sec.)	Time quantum	Priority	Arrival time
P_1	9	5 (sec.)	2	1
P_2	8		1	3
P_3	11		3	0
P_4	6		0	2

   Draw the Gantt charts for both of the above scheduling method and find the average waiting time. **[15]**

OR

   a. How can you define critical section problem? Name and define the requirements for a solution to the critical section problem. **[10]**

   b. What is Semaphore? Explain how Semaphore is used to the solution of the Dining-Philosopher Problem. **[15]**

3. a. Define different types of contiguous memory allocation method. Explain fragmentations using examples. **[10]**

   b. What do you mean by address binding? Describe the multistep processing of a user program **[15]**

with necessary diagram.

4. a. Explain paging hardware with necessary diagram. [10]

b. Show a paging scheme with the following data:
The logical memory = 24 byte; the physical memory = 48 byte; page size= 6 byte; word size=1 byte.
Calculate physical addresses of one item data for each page. [15]

5. a. Write the Basic scheme of page replacement with diagram. [10]

b. Compare the FIFO and OPT page replacement algorithm using the following string of memory reference. Number of page frames= 4. Memory reference is: 701210130412432 [15]

6. a. Explain page fault handling with necessary diagram. [10]

b. Describe different types of directory structure with diagram. [15]

University of Asia Pacific
Department of Computer Science and Engineering
Semester Final Examination Fall-2021
Program: B.Sc. in CSE

Course Title: ICT Law, Policy and Ethics
Course No.: CSE 407, Credit: 2.00

Time: 3.00 Hour | Full Marks: 50

Answer any FIVE (5) of the following questions.
(You MUST answer each part of a question consecutively)

1. Write down the short version of the principles as mentioned in the ACM-IEEE Code of Ethics for Software Engineers. (10)

2. Mr. Sky is a well-known singer. He has won a number of awards including two national awards for his contribution to the culture. Recently he has been seen with his romantic interest Ms. Thunder in public. Some of their recent pictures posted in the social media made it evident that both of them are madly in love with each other. One of the pictures looked like this:

In that picture everyone came and commented that this was sheer violence of social norms. It was not acceptable in any manner whatsoever. They also verbally abused Mr. Sky and Ms. Thunder in the comment section saying that it is pornography. They said that it is against their religion to do such things before marriage and post it on social media. In response, Mr. Sky asked them to not to hide behind the screen and come in front to say this. Eventually, he also started to abuse them. In the given facts, what will be the legal consequences for each of the characters? Give your answer in the light of the Pornography Control Act, 2012 and the Digital Security Act, 2018. (10)

3. Critically analyse the provision regarding the authorities who do not come under the purview of the Right to Information Act, 2009. (10)

4. Mr. Censor is an industrialist. He is well known for his behaviour and wise decisions. Recently, he has become interested in international trade. For that, he went to the Ministry of Industries to understand the procedure for setting up an industry which will

work with poor farmers of Vietnam and Bangladesh. The idea of his industry is based on information sharing on agricultural crop mutation. However, the Ministry did not provide him with relevant information within the given time. Mr. Censor wants to make a complaint at this point regarding not getting information. Advise Mr. Censor. (10)

5. What is intellectual property? Mention the process of registering copyright in Bangladesh. (10)

6. Critically analyse the offences under the Pornography Control Act, 2012. (10)

7. Explain with examples Principle No. 4 of the full version of ACM-IEEE Code of Ethics for Software Engineers. (10)

Department of Computer Science & Engineering
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Final Examination **Fall 2021** **4th Year 1st Semester**

Course Code: CSE 401 **Course Title: Mathematics for Computer Science** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Consider the following Ackermann function to determine the value of A (1, 5). **[10]**

$$A(m,n) = \begin{cases} n+1, where, m = 0 \\ A(m-1,1), where, n = 0 \\ A\big(m-1, A(m,n-1)\big), otherwise \end{cases}$$

You must apply step by step general procedure to solve the above problem.

b. Define the general formula for *A (3, n)* of Ackermann function and determine the value of *A (3, 10)* using the formula. **[5+10=15]**

2. a. Explain Poisson distribution. **[5]**

b. The mean number of bacteria per milliliter of a liquid is known to be 7. Find the probability that in 1 ml of the liquid, there will be: (a) 0, (b) 1, (c) 2, (d) 3, (e) less than 4 **[10]**

c. The mean number of bacteria per milliliter of a liquid is known to be 7. Find the probability that in 1 ml of the liquid, there will be more than 4 bacteria. **[10]**

3. a. Calculate the Eigenvalues considering the following matrix: **[10]**

$$\begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$$

b. Determine the Eigenvectors considering the Eigenvalues found from Question 3 (a). **[15]**

4. a. The average number of major storms in your city is 3 per year. What is the probability that exactly 4 storms will hit your city next year? **[10]**

b. Consider a school with a total population of 150 persons. These 150 persons can be seen either as 'Students' and 'Teachers' or as a population of 'Males' and 'Females'. With below tabulation of the 150 people, what is the conditional probability that a certain member of the school is a 'Teacher' given that he is a 'Man'? **[15]**

	Female	Male	Total
Teacher	18	22	40
Student	52	58	110
Total	70	80	150

5. a. Suppose you have a dataset of weather conditions and corresponding target variable "Play" as mentioned below. So, using this dataset you need to decide that whether you should play or not on a particular day according to the weather conditions. Solve the problem using Naïve-Bayes theory. **[25]**

Weather	Play
Sunny	No
Overcast	Yes
Rainy	Yes
Sunny	Yes
Sunny	Yes
Overcast	Yes
Rainy	No
Rainy	No
Sunny	Yes
Rainy	Yes
Sunny	No
Overcast	Yes
Overcast	Yes
Rainy	No
Rainy	Yes

OR

5. a. A doctor knows that Cold causes fever 50% of the time. Prior probability of any patient having cold is 1/50,000 and the Prior probability of any patient having fever is 1/20. **[15]**

If a patient has fever, what's the probability he/she has cold? Solve the problem using Bayes theorem.

b. Discuss about Naïve-Bayes classifier. **[10]**

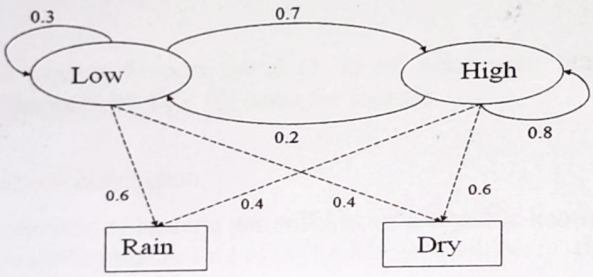
6. a. The following dataset is given: **[25]**

- Two states: 'Rain' and 'Dry'.
- Transition probabilities: P('Rain'|'Rain')=0.5 , P('Dry'|'Rain')=0.5 , P('Rain'|'Dry')=0.3, P('Dry'|'Dry')=0.7
- Initial probabilities: say P('Rain') = 0.4, P('Dry') = 0.6

Calculate the probability of a sequence of states {'Dry','Dry','Rain','Rain', 'Rain', 'Dry'}using Markov Model.

OR

6. a. **[25]**



The following represents five components of the Hidden Markov Model in the above diagram:

- Two states : 'Low' and 'High' atmospheric pressure.
- Two observations : 'Rain' and 'Dry'.
- Transition probabilities: P('Low'|'Low')=0.3 , P('High'|'Low')=0.7 , P('Low'|'High')=0.2, P('High'|'High')=0.8
- Observation probabilities : P('Rain'|'Low')=0.6 , P('Dry'|'Low')=0.4 , P('Rain'|'High')=0.4 , P('Dry'|'High')=0.3
- Initial probabilities: say P('Low')=0.4 , P('High')=0.6

Calculate the probability of a sequence of observations in our example, {'Dry','Rain'}.

Consider only the 1st term while calculating the probability.