

Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Final Examination Spring 2022 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. Describe the step by step procedure of the following Ackermann function to determine the value of $A(1, 2)$. [10] CO1

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

- b. Discuss the general formula for $A(2, n)$ of Ackermann function and determine the value of $A(2, 7)$ using the formula. [10] CO1

- c. Explain Poisson distribution. [5] CO1

2. a. Mr. Y sells burgers. 60% of people choose chicken, the rest choose something else. Analyze the probability of selling 5 chicken burgers to the next 10 customers using Binomial distribution. [25] CO2

3. a. In a cafe, the customer arrives at a mean rate of 2 per min. Calculate the probability of arrival of 5 customers in 1 minute using the Poisson distribution formula. [10] CO3

- b. The mean number of bacteria per milliliter of a liquid is known to be 10. Apply the theorem of Poisson distribution in finding the probability that in 1 ml of the liquid, there will be: (a) 0, (b) 1, (c) 2, (d) 3, (e) less than 4 [15] CO3

OR

4. a. Calculate the Eigenvalues considering the following matrix: [10] CO3

$$\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

- b. Determine the Eigenvectors considering the Eigenvalues found from Question 3 OR (a). [15] CO3

5. a. The average number of major cyclones in Khulna city is 3 per year. Calculate the probability that exactly 4 storms will hit the city next year. [10] CO3

- b. In a survey of 299 people, the data presented in the following Table were obtained relating gender to political orientation. A person is randomly selected. Determine the probability that the person is:
i. Male? [5*3=15] CO3

- ii. Male and Democrat?
- iii. Male given that the person is a Democrat?
- iv. Republican given that the person is Male?
- v. Female given that the person is an Independent?

	Republican (R)	Democrat (D)	Independent (I)	Total
Male (M)	74	39	21	134
Female (F)	85	64	16	165
Total	159	103	37	299

5.

- a. Suppose you have a dataset of weather conditions and corresponding target variable "Play" as mentioned in the Table 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. Assess the problem using Naïve-Bayes theory.

5

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 ✓

6.

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

[25] CO4

- b. Formulate Naïve-Bayes classifier.

[5] CO4

OR

- a. The following dataset is given:

- 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 $P('Rain') = 0.4$, $P('Dry') = 0.6$

[20] CO4

Estimate the probability of the states of consecutive six days { 'Dry', 'Dry', 'Rain', 'Rain', 'Rain', 'Dry' } using Markov Model.

- b. Formulate Markov Model.

[5] CO4

Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination

Spring 2022

4th Year 1st Semester

Course Code: CSE 403

Course Title: Artificial Intelligence and Expert Systems

Credits: 3

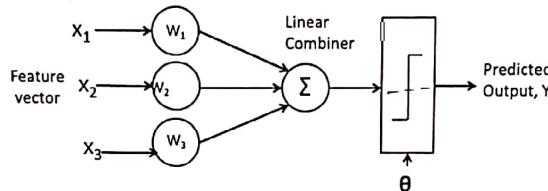
Full Marks: 150

Duration: 3 Hours

Instructions:

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

1. a) Summarize the back-propagation learning process in your own words. [5] CO5
- b) Differentiate between supervised learning and re-enforcement learning. [5] CO5
- c) For the following perceptron, the feature vector is $X = [1 \ 1 \ 0]$ and the desired output is $Y=1$. [15] CO5
- Consider the threshold value $\theta = 0.3$, learning rate $\alpha = 0.1$, initial weights $W_1 = 0.3$, $W_2 = 0.2$, and $W_3 = 0.4$. Measure the predicted output and calculate the updated weights (W_1 , W_2 and W_3) after one iteration.



2. a) What is Conditional Independence (CI)? Find out the CI relation of the following variables highlighting query variable, evidence variable and hidden variable. [5] CO4
- Fire, Smoke, and Alarm
- b) A training dataset of personal information of individuals and the corresponding target variable "Gender" of the person are given in Table-1. Convert the dataset into a Frequency Table. Create a Likelihood Table and calculate the posterior probability. Determine the 'Gender' of a person having height 6 feet, weight 130 lbs. and foot size 8 inch. Use naive Bayes algorithm for classification. [20] CO4

Table-1: Personal Information

Person	Height	Weight	Foot Size
male	6 ✓	180 ✓	10 ✓
male	6 ✓	180 ✓	10 ✓
male	5.5 ✓	170 ✓	8 ✓
male	6 ✓	170 ✓	10 ✓
female	5 ✓	130 ✓	8 ✓
female	5.5 ✓	150 ✓	6 ✓
female	5 ✓	130 ✓	6 ✓
female	6 ✓	150 ✓	8 ✓

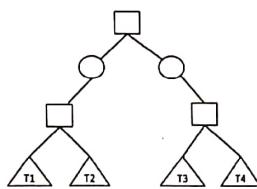
OR

- a) Explain the stationary assumption of Markov Model with proper example. [5] CO4
- b) Suppose the probability of raining on Sunday is 0.5. The Probability Transition Matrix is given in table-2. Calculate the probability of being "not raining" on Tuesday? Draw the Markov Chain and state transition diagram of the above scenario. [20] CO4

Table-2: Probability Transition Matrix

Today	Next day	Probability
rain	rain	0.8
rain	not rain	0.2
not rain	rain	0.3
not rain	not rain	0.7

- 3) a) Explain “Zero Sum Game” in Artificial Intelligence with necessary payoff matrix. [5] CO2
 b) What is the required condition for pruning a game tree? 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] CO2

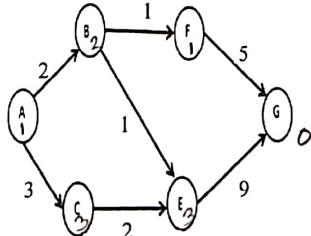


T1 = 3	T2 = -5
T3 = -2	T4 = T1+1

OR

- a) Define crossover and mutation with example. [5] CO2
 b) Simulate one step of Genetic Algorithm (selection, cross over and mutation) for the function in equation-1. Represent “x” using 4 bits. Population size is 5. For selection, you may use Roulette-Wheel Technique. $f(x) = \{\text{MAX}(2x^2): 0 \leq x \leq 15\}$ over $\{0, 1, \dots, 15\}$(1) [20] CO2

- 4) a) What are hedges in fuzzy logic? Illustrate how do hedges modify existing fuzzy sets? [2+5] CO3
 b) A group of 5 students of CSE department have been found to be very good ICPC volunteers with membership values: [0.5, 0.6, 0.7, 0.4, 0.8] respectively. Estimate what would be membership values in order to represent them to be a: i) extremely good ICPC volunteers ii) good ICPC volunteers and iii) more or less good ICPC volunteers. Also show the graphical representation for each of the ICPC volunteers. [18] CO3
- 5) a) Represent the following knowledge using First Order Predicate Logic (FOPL):
 David, William and Fiona are members of CSE sports club. Every member of sports club who is not a cricketer is a footballer. Footballer likes music, and everyone who does not like music is not a cricketer. David dislikes whatever Fiona likes and likes whatever Fiona dislikes. William likes music and rain. Is there any member of the sports club who is a footballer but not a cricketer? [15] CO3
 b) Determine if the statement $\{(P \vee \neg Q) \text{ and } (P \vee Q) \vee \neg P\}$ is satisfiable, contradictory, or valid? [10] CO3
- 6) a) What is admissibility and consistency of a good heuristic function? [5] CO2
 b) Your target is to reach the goal node ‘G’ from start node ‘A’ with the optimal cost. Simulate the following problem with A* search algorithm and show the shortest path with the fringe for each iteration. [20] CO2



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

Final Examination Spring 2022 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. Name and define the methods for handling deadlocks. [10]
- b. What is deadlock? Define the conditions of deadlock situation. Explain deadlock situation using Resource Allocation graph. [15]

OR

- a. What is the basic function of file system? Explain layered file system organization. [10]
- b. How file system is structured? Define in-memory file system structures with necessary diagram. [15]

2. a. What is the function of a Dispatcher? Explain different types of scheduling criteria. [10]
- b. Consider the following set of processes with the length of the CPU burst given in milliseconds: [5]

Process	Burst	Priority	Arrival
P1	20	3 ✓	0
P2	26	1	10
P3	25	4	20
P4	15	6	25
P5	10	5	35
P6	5	2 ✓	50

Draw Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: SJF(preemptive & nonpreemptive); Priority(preemptive & nonpreemptive). Calculate the average waiting time for each of the above mentioned scheduling algorithms. [15]

OR

- a. What is demand paging? Define implementation of demand paging with valid-invalid bit scheme. [10]
- b. Write short notes: Dynamic loading; Dynamic linking; Swapping. [15]

3. a. Explain the paging hardware with translation look aside buffer using necessary diagram. [10]
- b. Show a paging scheme with the following data:
The logical memory = 24 byte; the physical memory = 48 byte; page size= 4 byte; word size=1 [5]

byte.

Calculate physical addresses of one item data for each page.

[15]

4.

- a. What is memory Segmentation? Define the segmentation hardware with block diagram. [10] 
- b. Suppose there are five segments in a logical address space: Segment 0 (1000 words); Segment 1(400 words); Segment 2(400 words); Segment 3 (1100 words) and Segment 4 (1000 words). Show physical memory with segment table. Calculate physical addresses of one item data for each segment. [15] 

5.

- a. Write the Basic scheme of page replacement with diagram. [10]
 - b. Compare the LRU and OPT page replacement algorithm using the following string of memory reference. Number of page frames= 4. Memory reference is: 701210130412432871432 [15]
6. a. How free disk spaces are managed? Explain with examples. [10]
- b. Name and define different file allocation methods in disk blocks with necessary diagram. [15]

University of Asia Pacific
Department of Computer Science and Engineering
Semester Final Examination, Spring-2022
Program: B.Sc in Computer Science and Engineering, 4th Year 1st Semester
Course Title: ICT Law, Policy and Ethics
Course Code: CSE 407, Credit: 2.00

Time: 2 Hours

Full Marks: 50

Answer any FIVE (5) of the following questions.
(You MUST answer each part of a question consecutively)
(Consider all of the situations took place in Bangladesh.)

1. "By striking the right balance between the interests of innovators and the wider public interest, the IP system aims to foster an environment in which creativity and innovation can flourish." Do you think as a prospective software engineer learning the intellectual property law will help your creativity and innovation to flourish? Give reasons for your answer. 10
2. Critically analyze the paradoxical provision relating to the restricted information under the Right to Information Act, 2009. 10
3. Mr. and Mrs. Traitor have been married for two years and are very much in love. They often share intimate pictures of themselves with each other. After five years of their marriage they were having irreconcilable differences and separated on the same ground. Afterwards, Mrs. Traitor started an affair with another person. Mr. Traitor, desperately wanting Mrs. Traitor to feel ashamed of what she was doing started threatening her with their old intimate photos. Mrs. Traitor was completely shaken and wanted to take legal actions. Advise Mrs. Traitor in this regard. 10
4. Mr. Ringring is a proactive team member of a leading software developing company which creates software relating to educational games. Mr. Ringring presented an idea of a learning software using which hearing impaired children will be able to learn music. The idea was approved and his team started working on it where Mr. Ringring was assigned as the team leader. During the developing process Mr. Ringring learnt that a prototype of the same software has been developed by their rival company. Mr. Ringring fearing of losing his idea assigned one of the team members Mr. Lousy to access the rival company's computer and delete the relevant records. Mr. Lousy fearing of illegal acts reported the incident to the management. The management did not believe the allegation because of Mr. Ringring's good reputation in the company and retrenched Mr. Lousy. Discuss the legal points in the given fact based on the ACM-IEEE Code of Ethics and the Digital Security Act, 2018. 10
5. Explain the necessity of learning laws as a software engineer. 10
6. Ms. Rain wants to open a training centre in her locality for the disabled persons. She went to the appropriate authority in order to get the necessary information regarding the registration and permit procedure for the training centre. However, she was denied the access of such information without paying an excessive amount of fees. Discuss the legal remedies Ms. Rain has in this regard under the Right to Information Act, 2009. 10
7. Write down the short version of the ACM-IEEE Code of ethics for the software Engineers. 10

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

**Final
Examination**

**Spring
2022**

4th Year 1st Semester

Course Code: CSE-427

Course Title: Machine Learning

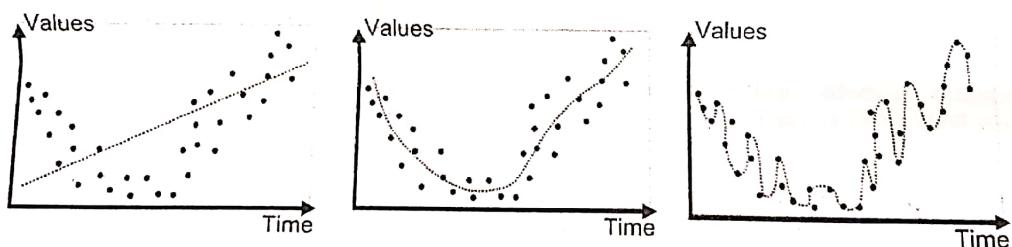
Credits: 3

Full Marks: 150

Duration: 3 Hours

Instructions:

- There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
 - Non-programmable calculators are allowed.
1. a. What is the cost function in Machine learning? Justify the use of different cost [5+5] CO1 functions for regression and classification problems.
- b. How does Naive Bayes algorithm work? [5] CO1
- c. What is the difference between underfitting and overfitting? Given the graph below identify which one is underfit, overfit or a goodfit: [10] CO1



2. a. A record of fruits containing multiple features is represented below. We have a long, sweet and yellow fruit. Determine whether it is **banana**, **orange** or **other** applying Naive Bayes' algorithm. [10] CO2

Fruit	Long	Sweet	Yellow	Total
Banana	400	350	450	500
Orange	0	150	300	300
Other	100	150	50	200
Total	500	650	800	1000

[15] CO2

- b. Your problem statement is to study this data set below and compute the Information gain (IG) for the speed of a car (response variable) as either slow or fast, depending on the following predictor variables:

- Road type
- Obstruction
- Speed limit

Road type	Obstruction	Speed limit	Speed
steep	yes	yes	slow
steep	no	yes	slow
flat	yes	no	fast
steep	no	no	fast

OR

- a. Apply KNN algorithm to predict diabetic patients with the given features: BMI and Age using the training examples represented below. In the column, "Diabetes", 1 indicates 'diabetic' and 0 indicates 'no diabetes'. Assume K=3. If a patient aged 40 has a BMI of 43.6, predict whether he has diabetes or not.

BMI	Age	Diabetes
33.6	50	1
26.6	30	0
23.4	40	0
43.1	67	0
35.3	23	1
35.9	67	1
36.7	45	1
25.7	46	0
23.3	29	0
31	56	1

- b. Calculate the minimum and maximum distance from a point (5,4) to any point on the circumference of a circle, $x^2+y^2=4$ using Lagrange Multipliers method.

3. a.

[25] CO2

x	y'	y
4		3
8		5
1	.	3
2		2

Given the Parameter initializing:

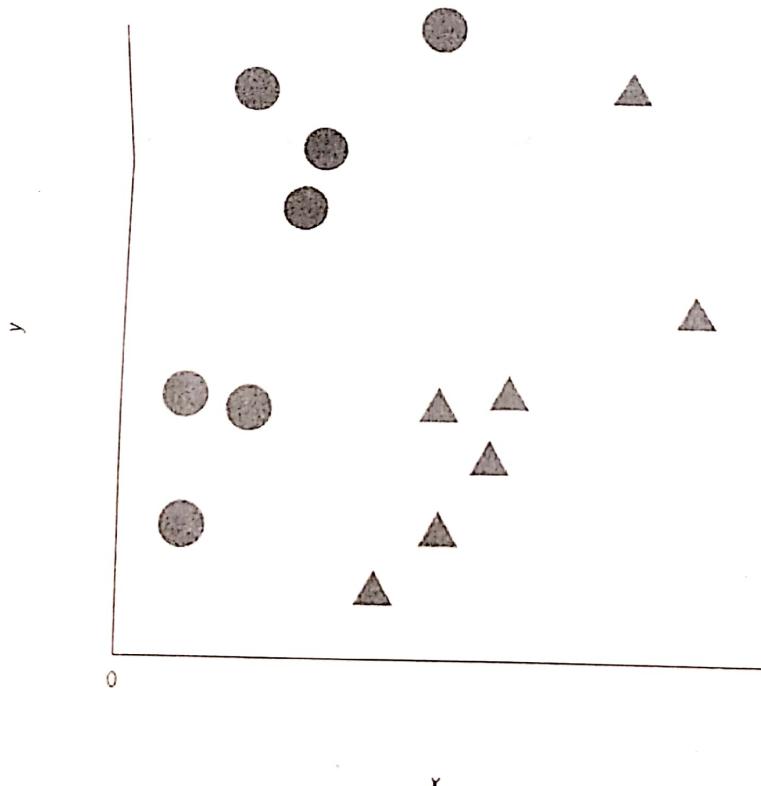
$$\theta_0 = 3, \theta_1 = 4$$

Compute the Hypothesis function, cost function and update the value of θ_0 and θ_1 after one iteration from the above dataset.

4.

- a. What are the Support vector points in the given graph below? Draw the best fit margin between the two classes.

[5] CO2



b.

Person	height (feet)	weight (lbs)	foot size (inches)
male	6	180	12
male	5.92	190	11
male	5.58	170	12
male	5.92	165	10 ✓
female	5	100	6 ✓
female	5.5	150	8 ✓
female	5.42	130	7 ✓
female	5.75	150	9 ✓

Classify whether a given Person (below) is a male or a female based on the measured features (above dataset) using Bayes formula:

Person	height (feet)	weight (lbs)	foot size (inches)
?	6	130	8

5.

- a. A neural network containing a single hidden layer is represented below in Figure-1. Assume that the neurons have a sigmoid activation function. The actual output of y is 1 and the learning rate is 0.9. Perform a forward pass on the given network.

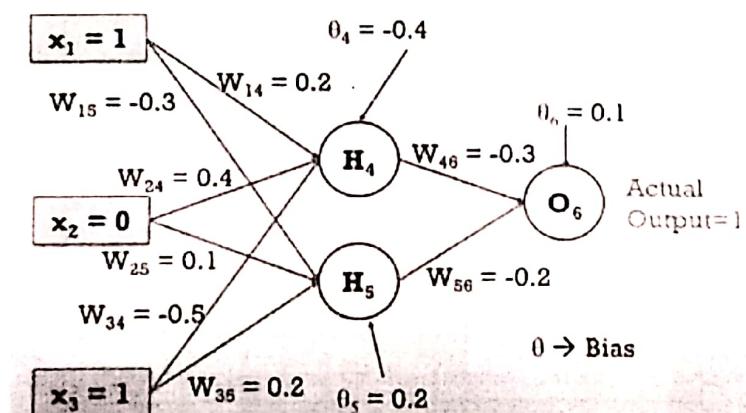


Figure 1: Neural Network

- b. "A single neuron functions as a logistic regression algorithm" – Do you agree with this statement? Provide justification in favor of your answer. [10] CO1

OR

- a. Discuss the basic idea of the backpropagation algorithm. Analyze various steps included in the backpropagation algorithm, using a small network with two inputs, two outputs and one hidden layer. [15] CO3
- b. "An artificial neuron is an imitation of a human neuron" - Explain how ANN works in light of this statement using appropriate figures. [10] CO1

6. a. Suppose you designed a prediction algorithm that can predict whether a person has COVID-19 or not. You examined 1000 people's data. Now, the prediction result and the actual result is indicated as follows— [5*5 =25] CO4
- i. Number of persons has Covid-19 and predicted the same – 12.
 - ii. Number of persons has Covid-19 and predicted the opposite – 6.
 - iii. Number of persons who do not have Covid-19 and predicted the same – 974.
 - iv. Number of persons who do not have Covid-19 and predicted the opposite – 8.

Create the confusion matrix indicating True Positive, True Negative, False Positive and False Negative. From the confusion matrix determine the following performance measure:

I.	Accuracy	$\frac{TP + TN}{TP + TN + FP + FN}$
II.	Precision	$\frac{TP}{TP + FP}$
III.	Recall	$\frac{TP}{TP + FN}$
IV.	Specificity	$\frac{TN}{TN + FP}$

$$1 - FPR$$

$$\frac{TN}{TP + TN + FP}$$