NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES, KARACHI CAMPUS

SPRING 2020 CS-Department

Final Exam
07th July 2020, 9:00 am – 12:30 pm

Course Code: CS 401	**Course Name: Artificial Intelligence**
Instructor's Name:	**Dr. Fahad Sherwani, Miss Nida Pervaiz, Miss Saeeda Kanwal**
Sections	**A, B, C, D, E, F**

Instructions:

Submission using Google Classroom

- Start of Exam: **9:00 am**; End of Exam: **12:30 pm including submission time.**
- Read each question completely before answering it. There are **5 questions and 4 pages**.
- In case of any ambiguity, you may make assumptions. But your assumption should not contradict any statement in the question paper.
- You will attempt this paper **offline**, in your **hand writing**.
- You may use **cam-scanner**, **MS lens** or any equivalent application to scan and convert your hand-written answer sheets in **a single PDF file**
- The paper should be submitted using **Google Classroom**. You are given **30 minutes** for this purpose, which is already included in the exam time mentioned above. Additionally, after submitting, you should **email it to your instructor** which should be exactly same pdf as uploaded earlier.
- **WRITE YOUR ID ON TOP OF EVERY PAGE by your hand.** Write also **page # on every page. You should also sign on every page.**
- **Plagiarism and cheating of any kind is strictly not allowed.**

Time: 3 Hours **Max Marks:** 50 Marks

Question No. 1 **[Marks: 5+5]**

A) The outbreak of the coronavirus pandemic has completely affected the educational system worldwide, leading to the near-total closures of academia impacting about 98.5 percent of the world's student population. So, as an ingenuity action HEC allowed universities and degree awarding institutes to continue online education and conduct examinations by making a new policy without compromising the health and safety factors. For which FAST NUCES has decided a policy of S/U and Letter grade for final examination. But in an online meeting with classmates you noticed that it was difficult for everyone to choose which policy will be more effective.

So, you are required to make a classifier using K-Means Algorithm to divide the observation into TWO clusters **(C1=S/U Policy) and (C2= Letter Grade)** using the following dataset rows according to your roll number digits.

For Example as shown in Figure 1 below, For 19k-2858 choose all relevant rows even if a digit is repeated twice or thrice (choose the 1st, 9th, 2nd, 8th, 5th and 8th row again) and make a new table.

Digit	A	B
0	3	3
1	8	5
2	4	4
3	2	4
4	7	7
5	5	8
6	3	5
7	4	8
8	6	9
9	9	6

Digit	A	B
1	8	5
9	9	6
2	4	4
8	6	9
5	5	8
8	6	9

Figure 1: Example data selection for Roll No. 19k-2858

B) Consider a fictitious document collection. There are 6 documents in this collection and these are represented as 6 points in two-dimensional vector space as follow:

D1	(2,1)
D2	(1,1)
D3	(4,1)
D4	(1,2)
D5	(2,2)
D6	(4,2)

Suppose that the distance between a pair of documents is measured by the Euclidean distance between their corresponding points. Show that how the k-means algorithm (with k=2) clusters these documents, using D2 and D3 as seeds.

Question No. 2 **[Marks: 5+5]**

A) Draw the Bayesian Network that corresponds to this conditional probability:

P(A | B,C,E), P(B | D,E), P(C | F,H), P(D | G), P(E| G,H), P(F | H), P(G) P(H)

B) Calculate P(OS=PASS | ITC=PASS) using the network given below.

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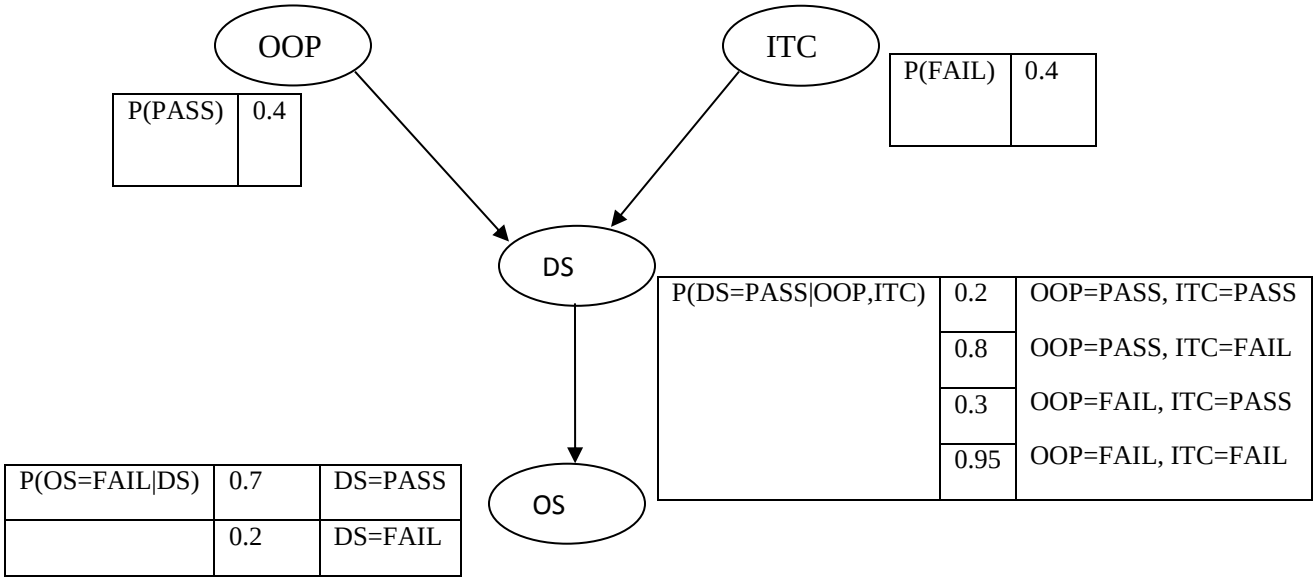

Question No. 3 **[Marks: 3+7]**

A) Define Constraint Satisfaction Problems (CSPs) and list any three examples of CSPs with their respective variables, domains and constraints.

B) Draw an arc consistent network based on the following attributes and write down the domain values for each variable that make the network consistent:

Variables: A, B, C, D, E

Domain: A={1, 2 ,3 4}, B={1, 2 ,3 4}, C={1, 2 ,3 4}, D={1, 2 ,3 4}, E={1, 2 ,3 4}

Constraints: (B≠3), (C≠2), (A≠B), (B≠C), (B≠D), (C<D),
(A=D), (E<A), (E<B), (E<C), (E<D)

Question No. 4 **[Marks: 3+7]**

A) What is Machine Learning? Name its types and discuss the difference between classification and clustering.

B) Following data is being provided from 10 patients, having some symptoms similar to that of Covid-19. Use this data to design and draw a decision tree for an automated system

which can decide if a patient should be tested for covid-19 or not. Also, show the calculations of Entropy and Gain.

Patient ID	Headache	Cough	Fever	Flu	Pain in body	Diagnosis
1	Yes	Yes	Yes	Yes	Yes	Covid-19
2	No	No	No	Yes	Yes	Allergy
3	Yes	Yes	No	Yes	No	Cold
4	Yes	No	Yes	No	No	Covid-19
5	No	Yes	No	Yes	No	Cold
6	No	No	No	Yes	No	Allergy
7	No	No	Yes	No	No	Covid-19
8	Yes	No	No	Yes	Yes	Allergy
9	No	Yes	No	Yes	Yes	Cold
10	Yes	Yes	No	Yes	Yes	Cold

Question No. 5 **[Marks: 3+7]**

A) Can Breadth First Search (BFS) be used instead of Min-Max Algorithm in game play? Justify your answer.

B) Use Min-Max algorithm on the following game tree to find the best possible path for Max player that ensures to maximize its score. Also, apply Alpha-Beta pruning to reduce the computational time required to implement this game tree.