

4th Year 1st Semester B.Sc. (Hons.) Examination – 2020

Department of Computer Science and Engineering, University of Dhaka

CSE-4101: Artificial Intelligence

In-Course Examination

Time: 1 Hour 15 Minutes

Total Marks: 30 + “1”

[Answer all the following Questions]

1.

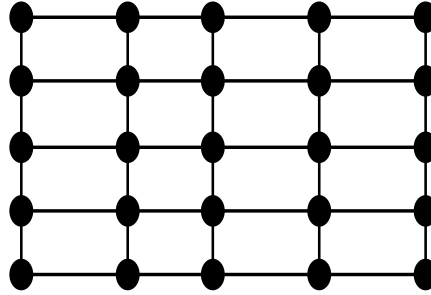


Figure 1

Consider a regular 2D grid shown in Figure 1. The start state is at the origin, (0,0), and the goal state is at some state (x, y).

- a. A heuristic function $h(n)$ is supposed to estimate the cost of a solution beginning from the state at node n . Is there any way we can use machine learning technique(s) to construct such a heuristic function? Provide reasonable explanation defending your answer. [3]

- b. In Figure 1, is $h = |u-x| + |v-y|$ an admissible heuristic for a state at (u, v) ? Is h admissible if some links are removed? Does h admissible if some links are added between nonadjacent states? [3]

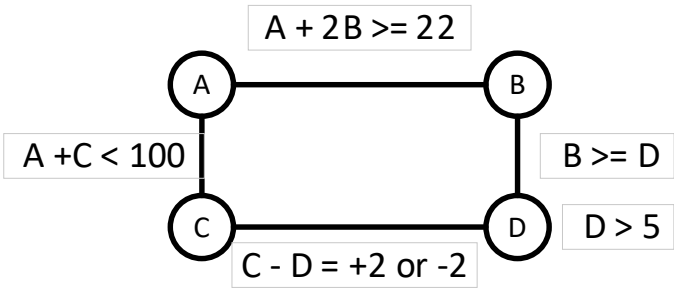
- c. How many nodes are expanded by A* graph search using h in the worst case? [1]

- d. Name an informed search algorithm wherein its evaluation function solely depends on its heuristic function. [1]

- e. Name at-least three ways to generate admissible heuristics from a given problem. [2]

2. a. In a CSP search algorithm, why it is a good heuristic to choose the variable that is *most* constrained but the value that is *least* constraining. [2]

b. Following is a constraint graph representing a CSP with four variables. Initially, enforce node consistency (if any), and then use AC-3 algorithm to make it Arc-Consistent. Finally, apply a local search algorithm to solve the Arc-Consistent CSP. [8]



Domain (A) = {4, 5, 6, 8}
Domain (B) = {1, 10, 15, 8}
Domain (C) = {1, 11, 5, 7}
Domain (D) = {4, 9, 6, 8, 9 }

3. The Turing Test, proposed by Alan Turing (1950), was designed to provide a satisfactory operational definition of intelligence. A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer. Mention the name of the skills that a computer would need to possess to pass this test. Why Alan Turing deliberately avoided “direct physical interaction” between the stakeholders of the test? Finally, precisely mention the intuition of the so-called “total Turing Test”?
- [2+1+2]
- i. Let’s assume that we have two types of environment: dynamic and static. Suppose we keep the agent program fixed but speed up the machine by a factor of two. Does that change the agent function? Your answer should consider each type of environment, separately.
- ii. Consider an architecture with n bits of storage, how many different possible agent programs are there?
- [3+2]

University of Dhaka
Department of Computer Science and Engineering
Incourse Exam

CSE-4102: Mathematical and Statistical Analysis for Engineers

Time: 1 Hour

Total Marks: 20 Minutes

Answer all the questions.

1.	<p>Many studies have been conducted to test the effects of non-vegetarian food on IQ level. In one such study, groups of vegetarians and non-vegetarians were tested for IQ level, with the results given below Use a 0.01 significance level to test the claim that the population of non-vegetarians has a lower mean than the vegetarians.</p> <p>Vegetarian users $n = 64, \bar{x} = 53.3, s = 3.6$ Non-vegetarian users $n = 65, \bar{x} = 51.3, s = 4.5$</p> <p>i. Write the NULL and alternate hypothesis. ii. What is the value of test statistic? iii. Write down the critical value. iv. What is the P-value? v. Write test results in non-technical terms. vi. Construct 98% confidence interval for the difference between the two population means.</p>	1+2+1 +1+1+2
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2.	If in predicting the value of a variable we have options to choose from a collection of predictor variables in regression, how would we make the best choice? What are the meanings (or interpretations) of the different parameter values you consider for making such a choice? Explain with example.	3												
3.	5 pairs of the Consumer Price Index (CPI) and the cost of subway fare shows a correlation coefficient $r = 0.867$. Using 0.05 significance level find out that whether there is a significant correlation between the CPI and subway fare. Write the critical values and the P-value. You have to clearly define how you came up with these values. Just writing the answers will not carry ANY marks.	3												
4.	A handicap can predict the winner of any cricket match 70% of time. What is the probability that he will correctly predict the outcome of next two cricket matches? You have to clearly define how you came up with these values. Just writing the answers will not carry ANY marks.	2												
5.	<p>A university president proposed that all students must take a course in ethics as a requirement for graduation. Three hundred faculty members and students from this university were asked about their opinion on this issue. The following table gives a two-way classification of the responses of these faculty members and students.</p> <table><tr><td></td><td>Favor</td><td>Oppose</td><td>Neutral</td></tr><tr><td>Faculty</td><td>45</td><td>15</td><td>10</td></tr><tr><td>Student</td><td>90</td><td>110</td><td>30</td></tr></table> <p>What is the probability that a randomly selected person from these 300 faculty members and students is in favor of the proposal or is</p>		Favor	Oppose	Neutral	Faculty	45	15	10	Student	90	110	30	4
	Favor	Oppose	Neutral											
Faculty	45	15	10											
Student	90	110	30											

	neutral? You have to clearly define how you came up with these values. Just writing the answers will not carry ANY marks.	
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University of Dhaka
Department of Computer Science and Engineering
In-course – Sem1 2020

Course Code: CSE 4126

Course Title: Introduction to Data Science

Full Marks: 20

Time: 60 minutes

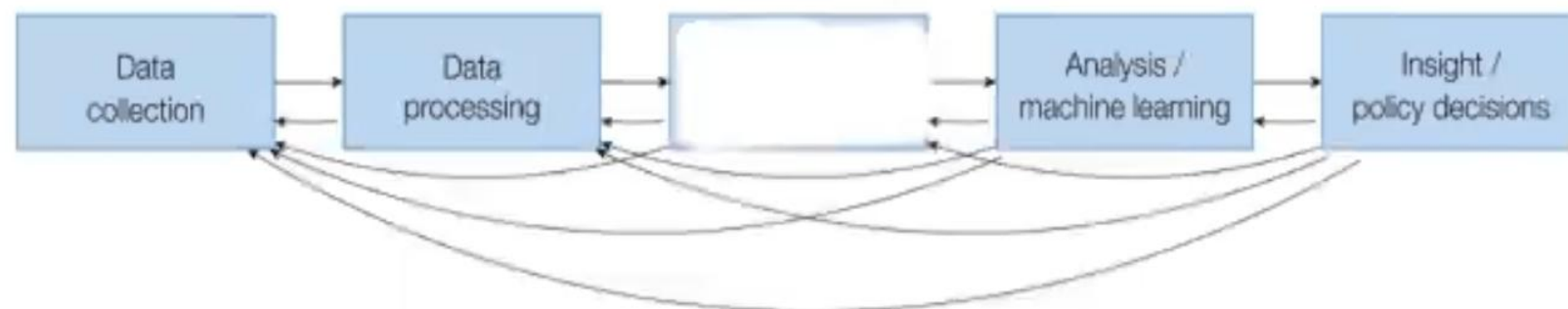
Name: _____

ID/Roll: _____

- (a "A process that involves computation, statistics, and fancy algorithms; and concerned about 1
 answering scientific questions including massive amounts of data." – is it a correct
) definition of Data Science? Why or why not?

- (b) The following transition diagram shows the operations involved in Data science. Write down the process in the blocked box. 1

)



- (c) What is the difference between indexes and indices? 2

- (d) What is the primary key for the following table, why? 2

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Role name	Salary	Job Level	Joining date	Date of birth
Tutor	56k	A	12/03/2003	13/1/1978
Head tutor	78k	B	12/04/2016	30/4/1990

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(e Which are not wrong? Why?

2

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- i. Nominal data is a specialized categorical data where order has no significance
- ii. Adding two categorical strict ordered data may produce an ordered data
- iii. Age class $\{<18, 18-24, 24-28, >28\}$ is neither ordinal nor nominal
- iv. Income is a ratio data

- (f) For the following matrix A, assuming the item with the cells having (odd row index, odd column index) or (even row index, even column index) has non-zero values exceptions exist for diagonals. If you are asked to find CSC format representation of the matrix, then complete the following functions that can be used to get CSC format.

2

$$A = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ A_{m1} & A_{m2} & \cdots & A_{mn} \end{bmatrix}$$

The generalized function for each item i.e. the data, row and column values, respectively, in data, row and column vector: (note, don't use "mod" operator in the below equations)

$$\underline{d_i} = \{ \underline{A_{j,k}} \} \quad \text{iff}$$

$$j = \underline{\hspace{2cm}}, k = \underline{\hspace{2cm}} \text{ or } \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$$

$$\underline{r_i} = \{ \underline{\hspace{1cm}} \} \quad \text{iff}$$

$$\underline{c_i} = \{ \underline{\hspace{1cm}} \} \quad \text{iff}$$

(g) Suppose we have a directed graph with n nodes where each node has fewer than some constant $k \ll n$ ingoing or outgoing edges. In the adjacency dictionary representation, which of the following operations are constant time ($O(1) \equiv O(k)$)? 2

1. Checking if there is a link between two nodes $A \rightarrow B$
2. Finding all the outgoing edges of a node A
3. Finding all the incoming edges of a node A
4. Deleting all outgoing and incoming edges of a node A
5. Deleting the link between two nodes $A \rightarrow B$
6. Adding a new node Z to the graph and adding links $A \rightarrow Z, Z \rightarrow B$

- (h) For the following corpus, build a Bag of words X in the given matrix (if more than 10 words are found just put any 10),

1

"I love my country, hence I come back in my dream and I come back in real forgetting all the bitter realities of this country."

"X is a greedy and selfish person. They know how to best use of the available opportunities no matter how bad the associated paths are."

"I know my country is for selfish, greedy and cunning people. They are successful in every sector and they are united."

"What should I do now. Fight against them? Unite with them? Stay calm and quiet? Run away? Hahaha. Confused!!!"

Consider the following word list as stop words:

a, about, above, after, again, against, all, am, an, and, any, are, aren't, as, at, be, because, been, before, being, below, between, both, but, by, can't, cannot, could, couldn't, did, didn't, do, does, doesn't, doing, don't, down, during, each, few, for, from, further, had, hadn't, has, hasn't, have, haven't, having, he, he'd, he'll, he's, her, here, here's, hers, herself, him, himself, his, how, how's, I, i'd, i'll, i'm, i've, if, in, into, is, isn't, it, it's, its, itself, let's, me, more, most, mustn't, my, myself, no, nor, not, of, off, on, once, only, or, other, ought, our, ours, ourselves, out, over, own, same, shan't, she, she'd, she'll, she's, should, shouldn't, so, some, such, than, that, that's, the, their, theirs, them, themselves, then, there, there's, these, they, they'd, they'll, they're, they've, this, those, through, to, too, under, until, up, very, was, wasn't, we, we'd, we'll, we're, we've, were, weren't, what, what's, when, when's, where, where's, which, while, who, who's, whom, why, why's, with, won't, would, wouldn't, you, you'd, you'll, you're, you've, your, yours, yourself, yourselves

Calculate the TFIDF values for any five words from X in the next matrices. Use Cosine similarity among that five words.

University of Dhaka
Dept. of Computer Science and Engineering
4th year First Semester 2020
Incourse Examination
CSE-4134: Software Project Management

Duration: 1hr 20 minutes

Full Marks: 30

1. You are working for We Are Big, Inc., an international firm with over 100000 employees located in several different countries. A strategic goal is to help improve the environment while increasing revenue and reducing cost. There are several projects on this issue-one of them is Green Computing Research project. The CIO, Ben, is the project sponsor and he has given this project high priority. The main purpose of the Green Computing Research Project is to research possible applications of green computing including:

- Data center and overall energy efficiency
- The disposal of electronic waste and recycling
- Telecommuting
- Virtualization of server resources
- Thin client solutions
- Use of open source software
- Development of new software to address green computing for internal use and potential sale to other organizations

The budget of the project was \$500,000, and the goal was to provide an extensive report, including detailed financial analysis and recommendations on what green computing technologies to implement. Ben decided to have a small group of people, five to be exact, dedicated to working on this six-month project full-time and to call on people in other areas on an as-needed basis. You have been selected as the project manager for Green Computing Research Project. You are encouraged to use outside consultants and other resources, as appropriate. The main product you'll produce will be a series of research reports-one for each green computing technology listed earlier plus one final report including all data-plus formal project proposals for at least four recommendations for implementing some of these technologies. Ben thought some type of decision support model would make sense to help collect and analyze the project ideas. Ben also provide sample of research report as well as project proposal.

You have to develop

- | | | |
|-----|----------------------------|----|
| i) | Project charter | 10 |
| ii) | Work break down structure. | 10 |
2. a) Compare and contrast between process group and knowledge area. 5
- b) Compare and contrast among functional, matrix and project based organization. 5

Mid Term Examination
4th year, 2nd Semester B.Sc (Hons.)'2020
Department of Computer Science and Engineering
University of Dhaka

Total Mark: 30

Total Time: 1 hour 20 minutes

Answer Q3 and choose any Four (4) from the remaining questions:

1. What is “unconditional security” and “~~conditional~~ ^{computational} security”? Explain with an example why EX-OR operation is important for encryption operation. 2+4=6
2. In onetime pad you cannot use the same key to encrypt more than one messages. Suppose you encrypt two messages of same length with the same key. Describe elaborately what kind of vulnerabilities exist if you are provided only with the ciphertexts of these two messages. 4+2=6
(ii) Is it possible to reuse a key without creating any security vulnerabilities? Argue in favour of your answer.
3. Consider a set of polynomials that belong to the finite field $GF(2^3)$ using the irreducible polynomial $m(x) = x^3 + x + 1$. 3+3=6
(i) List all the polynomials. Explain the reasons.
(ii) Construct the multiplication table and list the multiplicative inverse for each polynomial.
(iii) Find the result of
4. (i) Find the multiplicative inverse of each element of Z_5 . 2+4=6
(ii) List out the steps to find the multiplicative inverse using the Extended Euclidean algorithm for $135 \bmod 61$.
5. Define confusion and diffusion. Describes how these two properties are achieved in AES. (Mention the AES algorithm steps and explain their operations). 6
6. AES decryption is not identical to AES encryption. Explain the changes you need to make to perform the AES encryption and decryption using the same circuit? Draw the AES decryption circuit after you make the necessary changes. 4+2=6
7. Explain the working procedure with the underlying design principle of Cipher Block Chaining. What are advantages and disadvantages of CBC and Output Feedback mode? 6

University of Dhaka
Subject: Computer Science and Engineering
Midterm Examination of 4th Year 1st Semester, 2020, (on 8th March, 2020)
Course Title: Computer Graphics. Course Code: CSE-4103/4139

Full Marks: 60

Answer Any Three

Time: 1:30 Hrs.

1. Let you have to draw a line from $P_0(-8, 21)$ to $P_1(-20, 30)$.

- (a) Derive initial deviation (d_{init}) and its essential derivatives of the above line using mid-point line-drawing algorithm. 4
- (b) Write the algorithm for drawing the above line. 2
- (c) Determine the next 8-pixel coordinates of the line starting from P_1 including the values of decision variables in each stage using midpoint line drawing algorithm. 4

2. Suppose you are instructed to draw an ellipse from region-2 to region-1, that is the starting point of the ellipse is $(a, 0)$.

- (a) Explain the termination criteria for the above case (i.e., from region-2 to region-1). 4
- (b) Determine the first 8-pixel coordinates from $(20, 0)$ of the above ellipse including the values of decision variables in each stage, given that $a=20$ and $b=12$. [Given that the center of the ellipse is $(-20, 0)$] 6

3. (a) Make a list of t for all edges in Cyrus-Beak line clipping algorithm 2

- (b) Determine the value of t for each of the following lines for all edges, specify whether they are entering or leaving t . (Given $(-120, -100)$ to $(120, 100)$ are the diagonal corners the clip region). 4
- (i) $(-150, -200)$ to $(150, 200)$. (ii) $(200, 120)$ to $(-300, -110)$.
- (iii) $(-150, 120)$ to $(100, -100)$. (iv) $(-250, 400)$ to $(250, -200)$.

- (c) Make region-outcode for each endpoint for the following 3D lines and determine whether they are accepted / rejected / partial accepted using Cohen-Sutherland line clipping algorithm. Given that $(-120, -100, -80)$ and $(120, 100, 80)$ are the diagonal corners of the clip region. 4
- (i) $(-150, -200, -81)$ to $(150, 200, -100)$. (ii) $(200, 120, 85)$ to $(-300, -110, 0)$.
- (iii) $(-120, 100, -80)$ to $(100, -100, 80)$. (iv) $(-250, 400, 120)$ to $(250, -200, -60)$.

4. (a) Let $A(0,0)$, $B(6,3)$, $C(6,7)$, $D(3,4)$ and $E(0,7)$ are the corners of a pentagon. Draw (i) Edge Table and (ii) Active Edge Table of $ABCDE$ pentagon for polygon filling using scan-line algorithm. Finally draw the boundary pixels from AET. 2.5+ 2.5+ 1

- (b) Let $A(10,10)$, $B(90,30)$, $C(70,50)$, $D(100,80)$, $E(60,60)$, $F(30,90)$ and $G(10,70)$ are the corners of a hexagon. Draw the new polygon using Sutherland-Hodgeman polygon clipping algorithm Given that $(0, 0)$ and $(80, 80)$ are the diagonal corners of the clip region. 4