B.Sc. Engg. / HD CSE 8th Semester **15 November 2020**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID EXAMINATION **SUMMER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 3 x 25**

CSE 4807: IT Organization and Management

Programmable calculators are not allowed. Do not write anything on the question paper.

Figures in the right margin indicate marks.

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1. Read the following paragraphs about recent analysis of a famous supermarket. 4x6.25 = 25

   100 years ago, Jack Cohen, a former member of the Royal Flying Corps, invested the demobilization money he received at the end of World War I to set-up shop in London. On his first day, he made a profit of £1 for £4 of sales. That was the start of Tesco – UK's biggest supermarket.

   After a devastating accounting scandal caused a £6.4 billion loss in 2015, people thought Tesco's run at the top of the supermarket chains was over. However, Tesco recovered from an annual loss of £6.4 billion in the annual report of 2015 to an operating profit of £1.9 billion in the annual report of 2020. Tesco has 26.9% of the grocery market share in Great Britain, which is the highest market share. Dave Lewis ended his chapter as CEO of Tesco in the last September. Ken Murphy, the new CEO has the challenge to accelerate the development achieved by Mr. Lewis.

   Tesco paid £175,000 in fine for displaying products 15 days past their expiry date. In addition, they issued urgent food recalls after discovering safety issues and defects that endanger customers. An article in the Guardian shows a massive decline in employment numbers for people aged 16-24 years, for whom super shops are convenient workplace. Brexit will affect 80% of the imported food sold in supermarkets. Also, rising unemployment adds another layer of financial uncertainty for Tesco's patrons.

   Despite the pandemic, Tesco registered a 10.5% growth in the last three months to September, which came through online sales. In response to pandemic-triggered restrictions on in-store purchases, Tesco was able to double its delivery capacity to 1.5 million slots. However, corona virus-related expenses hit £533 million for the company. Measures to prevent the spread of COVID-19 also prevent people from stepping out, which in result popularized buying products online. Besides, Using AI and machine learning to predict and deliver street-level requirements could be a game-changer.

   Now, find the Strengths, Weaknesses, Opportunities and Threats of the company from the given information.

2. VRIO analysis of the resource/capabilities of a certain coffee shop given below. **For each resource/capabilities find out the competitive implication. Also, give your reasoning behind your implication in brief.** 5x5=25

Resource/ Capability	Valuable?	Rare?	Inimitable?	Organized to Exploit?
Strong Global Presence	Yes	Yes	Yes	Yes
Specialty Coffees	Yes	No	No	Yes
Upscale and Cozy atmosphere	Yes	Yes	No	Yes
Special ingredients	Yes	Yes	No	Yes
Exclusive Brand Ambassador	Yes	No	Yes	Yes

Hint: Competitive implications are - competitive advantage/disadvantage/parity. Moreover, these can be temporary or sustainable.

3. a) Mention the disadvantages of individual decision-making and group decision making. Give two scenario where you will follow these decision making process. 6+4

   b) Define "Management" from your own perspective. Explain the roles managers need to play in the organization. 2+8

   c) Illustrate the steps in planning process. Write the main difference between Strategic, Tactical and Operational planning. 2+3

B.Sc. Engg. 8th Semester **09 November 2020**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2019-2020**

TIME: 1 Hour 30 Minutes **FULL MARKS: 50**

CSE 4809: Algorithm Engineering

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **3 (three)** questions. Answer **all** of them. Figures in the right margin indicate marks.

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1. a) **(Write answers with *single sentence* only)** 1x5
   i. Why are asymptotic notations important?
   ii. How does divide and conquer help merge sort algorithm in sorting?
   iii. Why does quick sort algorithm just have division (i.e. partition) cost but does not have any merging cost?
   iv. What do you understand by polynomial time algorithm?
   v. Why are we not interested in exponential time algorithms for solving a problem?

   b) Write an algorithm to find the median of a data array in linear time. 6.66

   c) Find the solution to the resursion $T(n) = 6T(n/2) + n^2 \lg n$ using master methd. 5

2. a) **(Write answers with *single sentence* only)** 1x5
   i. What do you understand by 'decidability' of a problem?
   ii. Why do logic problems sometimes become un-decidable?
   iii. What is an approximation ratio of a suboptimal algorithm?
   iv. Define NP.
   v. Why is Turing famous for –solving halting problem or for Turing machine?

   b) Do the reductions in simple words (do not need equations or derivations): 2x3
   i. Reduce 'Hamiltonian cycle' finding problem to 'Cycle finding' problem in a graph.
   ii. Reduce 'Hamiltonian path' finding problem to 'longest simple path' finding problem.

   c) Describe how 2-SAT problem is solved. (i.e. when it is decidable and when it becomes undecidable). 5.66

3. a) **(Write answers with *single sentence* only)** 1x5
   i. How does dynamic programming save computation of a combinatorial optimization problem?
   ii. Every problem that has an optimal greedy algorithm should also have a dynamic programming solution- why or how?
   iii. Can dynamic programming algorithm be used in a path finding problem where the problem is to find the list of paths within a ratio of the optimal paths?
   iv. There can be some algorithm possible to devise for 3.iii). What will be complexitiy of such an algoirthm in general?
   v. Why do we use bottom up solution for a dynamic programming algorithm rather than using top- down approach?

   b) DTW algorithm can be used to solve LCS problem? Explain how. 6.66

   c) How does markovian propertiy helps to derive the optimal substructure equation of viterbi algorithm? 5

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MID EXAMINATION **SUMMER SEMESTER, 2019-2020**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4803: Graph Theory

Programmable calculators are not allowed. Answer all the questions.
Figures in the right margin indicate marks.

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1. a) Determine whether or not the following sequences represent simple graph. If the sequence represents simple graph, draw a corresponding graph. If not, justify. 9
   i. (2, 3, 3, 4, 4, 5)
   ii. (2, 3, 4, 4, 5)
   iii. Your Student ID (comma separated digits, sorted in ascending order)
   iv. (1, 3, 3, 3)
   v. (1, 2, 2, 3, 4, 4)
   vi. (1, 3, 3, 4, 5, 6, 6)

   b) One of your friends from CEE department has designed an apartment floor. Consider the drawing of an apartment with doors in Figure 1 as your friends drawing. 9

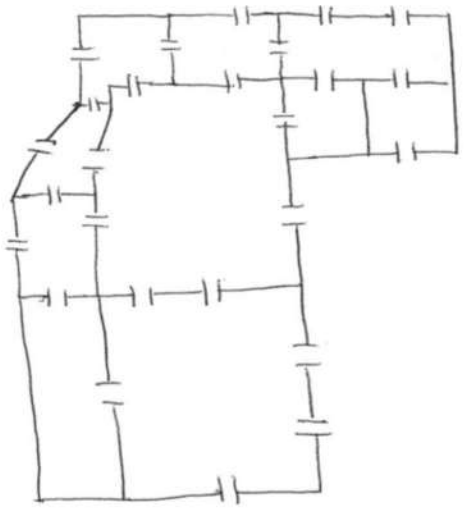


Figure 1: Floor Plan

   i. Can you find a continuous line that passes through each door exactly once? If not, At least how many doors are needed to be closed to have a continuous line that passes through each door exactly once?
   ii. If we transform this floor plan into a graph, what should the vertices and the edges represent? What does the graph look like?
   iii. Find a continuous line that passes through each door exactly once after closing the minimum numbers of doors.

   c) As a *Tom & Jerry* fan in your childhood, you used to draw *Jerry* mouse as your favorite character. One of such drawing is depicted in Figure 2(a). This drawing can be translated into a graph shown in Figure 2(b). 2.5

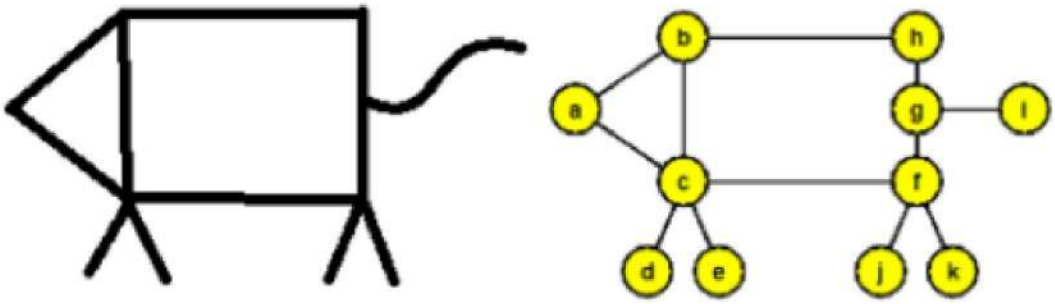


Figure 2: (a) A conceptual drawing of *Jerry* mouse, (b) Translation of the given mouse into a graph

Find the number of the minimum trails as possible covering the given graph? Draw the trails with distinguishable patterns.

[Hine: An Euler/semi Euler graph needs only one trail.]

d) Consider the graph G in Figure 3. Is G Eulerian? Is G Hamiltonian? Is G bipartite? Justify your answers. 4.5

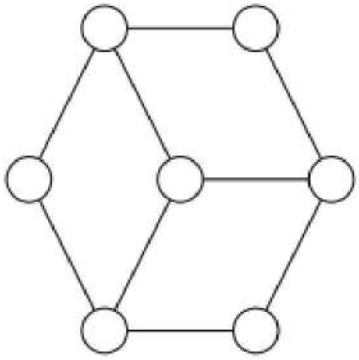


Figure 3: Simple graph G

2. a) How many isomers does Hexane (C_6H_{14}) have? Draw the structure of the carbon atoms in each isomer. 5

b) Connected acyclic graphs are known as *Tree*. 4+4

i. A finite tree T has at least one vertex v of degree 4, and at least one vertex w of degree 3. Show that T has at least 5 leaves.

ii. Let T be a tree with p vertices of degree 1 and q other vertices. What is the sum of the degrees of the vertices of degree greater than 1?

c) In Springfield Nuclear Power plant, there are 16 staff houses. An inexperienced engineer was hired to develop a network that will connect all the houses together. The engineer built a grid-like architecture for the network which is shown in Figure 4. This plan is submitted to you (an expert) for your approval. 12

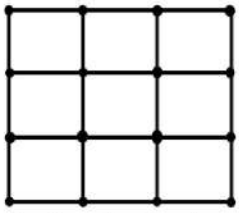


Figure 4: Designed network architecture

i. What are the Vertex and Edge connectivity of this graph?

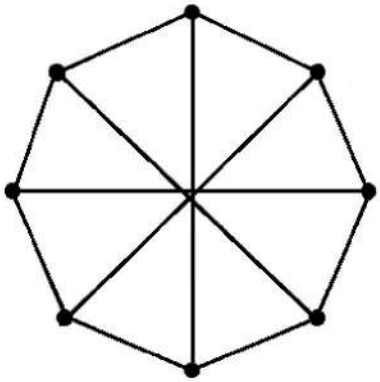
ii. If you are asked to check all the connection starting from the top-left house and returning to it. What is the minimum unit of distance you need to cover? Given that all the connections have unit distance?

iii. Can you design a more stable architecture? If not, describe why. Otherwise, draw the network.

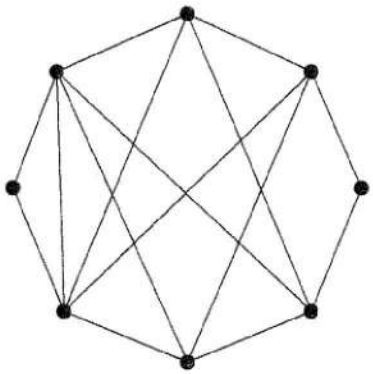
3. a) Draw 4 simple completely regular planar graphs with vertex degree ≥ 3. 8

b) Show that, if G is a 3-connected plane graph, then its geometric dual is a simple graph. 4

c) Determine if the following graphs in Figure 5 are planar. If yes, give a planar representation. If not justify. [Hint: drawing is not a justification] 8



i.



ii.

Figure 5: Graphs for question 3(c)

d) A 5-regular planar graph has triangular regions. Find all possible number of vertices, edges and regions. 5

B.Sc. Engg. CSE 8th Semester **11 November 2020**
B.Sc. TE (2-Yr)
B.Sc. TE (1-Yr)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4849: Human-Computer Interaction

This is a closed book online written exam. Answer script in pdf should be uploaded in the Google classroom of this course. In case of uploading problem send to WhatsApp number 01844056187

Answer the following **3 (three)** questions.
Figures in the right margin indicate marks.

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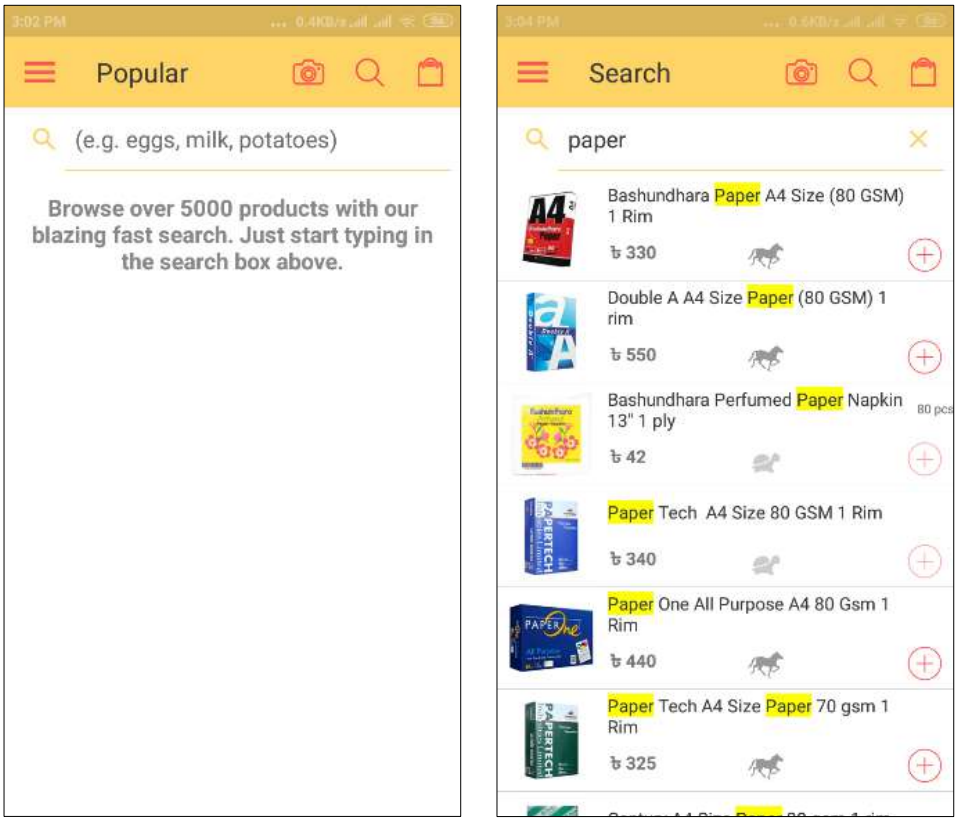
1. a) Due to the recent pandemic of COVID-19, we have already lost many lives. The Centers for Disease Control and Prevention (CDC) has already addressed an increase in adverse mental health conditions. Level of anxiety, depressive disorders if not monitored and treated adequately we may observe these patterns more arising. The toxic nature of many social media applications hampers wellbeing and productivity. Hence designing a mental health app requires a lot of studies that synthesize several aspects like, psychology, sociology, UX/UI issues, and so on. Based on the scenario answer the followings:
   i. Explain the interrelated aspects of Human-Computer Interaction (HCI) related to this mental health app for wellbeing. 15
   ii. Draw an HCI framework showing the aspects you considered appropriate for this application. 10

2. a) Suppose you have to design a computer vision-based system to recognize free-hand writing through index finger. While writing on air, a user can move his/her finger in 3D space and produce a sequence of patterns/features that need to be understood as a symbol like, ‘A’, ‘B’, ‘5’, ‘8’, etc. Answer the followings:
   i. How do we measure distance and understand our environment in 3D? 5
   ii. What are the depth cues do you think could be effectively utilized to extract important patterns/features to recognize the written symbols by a computer system? [Assume you have captured 2D gesturing images and the depth-map information of the gesturing hand provided by depth camera.] 12
   iii. If the gesturing images are 2D image sequence without depth-map information from depth camera then, how can you utilize different monocular cues to extract depth information? 8

3. a) Consider the searching task in the interfaces shown in Figure 1 (a) and 1 (b). You are given a choice to select two interaction styles for the task. One is writing a query string in the search box and another one is giving voice commands using natural language. You are asked to use the interaction model to analyze interaction problems involved for the task.
   Answer the followings:
   i. Describe different gulfs with examples in each stage of the interactions for these two styles of interaction and justify which interaction style will give a better user experience. 12
   ii. How can you assess the mappings of different translation languages through the interaction model for the searching task through the interfaces of Figure 1 (a) and 1 (b)? Explain. 13



(a) (b)

Figure 1: Search interfaces in a mobile application

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MID TERM EXAMINATION **SUMMER SEMESTER, 2019-2020**

DURATION: 1 HOUR 30 MINUTES **FULL MARKS: 75**

CSE4851: Design Pattern

Write your **Name, Student-ID, and Course Code** on the top of the first page.
Put a serial number on the Top-right corner of each page
There are **3 (Three)** questions. Answer **All** of them. Figures in the right margin indicate marks.

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1. (a) What is Design Pattern? Describe two key advantages of applying design patterns. Name the type of the patterns. 5

   (b) For each part, write down the name of the design pattern or principle that would be most useful for addressing the situation described. 6

   i. You are building a system that relies on a complex algorithm, and that algorithm may be changed often due to marketing pressures. What pattern would best support this?

   ii. A pizza factory produces pizzas with various toppings. There are 20 different toppings and a customer may order any combination of toppings. Assume that each of pizza bread and each topping will be represented by a different class.

   iii. We are building a cricket app that notifies viewers about the information such as current score, run rate etc. Suppose we have made two display elements CurrentScoreDisplay and AverageScoreDisplay. CricketData has all the data (runs, bowls etc.) and whenever data changes the display elements are notified with new data and they display the latest data accordingly.

   (c) Explain a scenario where strategy pattern can be used. Write the corresponding code for that scenario. Also, draw the UML diagram for that scenario. 4+5+5

2. (a) Briefly, explain the purpose of the Decorator pattern. List three distinct advantages of factory methods over constructor. 5

   (b) Draw a UML diagram for Mediator pattern between web services and web clients. As web services, the Ebay auction house and Amazon are available. Plan functions to search for an item with a textual description, and to buy an item from the service that gives you the best price. 10

   (c) Identify a pattern which can Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically. Briefly explain that pattern. Also discuss the advantages and disadvantages of that pattern. 10

3. (a) We have used the term “program to an interface, not to an implementation”. Explain a pattern satisfying the statement with real world scenario. 5

   (b) Briefly discuss the usage of composition over inheritance. 5

   (c) Consider the following code- 5+5+5

```
public class Rental {
    private Movie _movie;
    private int _daysRented;

    public Rental(Movie movie, int daysRented) {
        _movie = movie;
        _daysRented = daysRented;
    }
    public int getDaysRented() { return _daysRented; }
    public Movie getMovie() { return _movie; }

    public double amountFor() {
        double thisAmount = 0;
        //determine amounts for each line
        switch (getMovie().getPriceCode()) {
            case Movie.REGULAR:
                thisAmount += 2;
                if (getDaysRented() > 2)
                    thisAmount += (getDaysRented() - 2) * 15;
                break;
            case Movie.NEW_RELEASE:
                thisAmount += getDaysRented() * 3;
                break;
            case Movie.CHILDRENS:
                thisAmount += 1.5;
                if (getDaysRented() > 3)
                    thisAmount += (getDaysRented() - 3) * 1.5;
                break;
        }
        return thisAmount;
} }

public class Movie {
    public static final int CHILDRENS = 2;
    public static final int REGULAR = 0;
    public static final int NEW_RELEASE = 1;

    private String _title ;
    private int _priceCode;

    public Movie(String title , int priceCode) {
        _title = title ;
        _priceCode = priceCode;
    }

    public int getPriceCode() { return _priceCode; }
    public void setPriceCode(int arg) { _priceCode = arg; }
    public String getTitle () { return _title ; }
}
```

i) Briefly explain the terms code refactoring and code smell.
ii) Identify two code smells which occur in the code.
iii) Refactor the code removing the smells.

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4801: Compiler Design

There are **3 (three)** questions. Answer all of them. Figures in the right margin indicate marks.

[Write your ***Name, ID, Course Code, Semester, Session*** *and* ***Date*** on top of your answer script and number the pages sequentially. Submit your script as pdf with the naming format '**ID-CSE4801-Mid.pdf**' i.e '**160041001-CSE4801-Mid.pdf'**. You must preserve hardcopy of your answer script and submit it to the department later.]

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1. a) Discuss various types of translator used in the field of computer science. 5

   b) A compiler is a program that can translate texts from one language to another language. Assume three languages L1, L2 and L3. You need to translate texts from each language to all other languages.

      i. How many different compilers do you need to do these translations? 1

      ii. How can you increase the efficiency and portability to construct all of these compilers? – discuss in detail. 10

   c) Discuss the uses of *yywrap()* function in Lex. 3

   d) Write a Lex program which can detect floating point constants (supported in C) from input text. Floating point number formats supported in C language are given below: 6

```
15
15.75
-15.75
+15.75
1.575E1   /* = 15.75   */
1.575e1   /* = 15.75   */
1575e-2   /* = 15.75   */
-2.5e-3   /* = -0.0025 */
25E-4     /* =  0.0025 */
10.0F     /* type float; possible suffices f, l, F, L or none */
.0075e2   /* integer portion may be omitted */
```

2. a) Discuss the weaknesses associated with Top-Down Parsing. 5

   b) Consider the following grammar:

$S \rightarrow Aa \mid bAc \mid Bc \mid bBa$
$A \rightarrow d$
$B \rightarrow d$

      i. Find the set of FIRST and FOLLOW for each of the non-terminal. 5

      ii. Find the Canonical LR(0) items and draw the transition diagram. 10

      iii. Build SLR parse table for the grammar. 5

3. a) What are the importance of input buffering? Discuss various techniques to implement input buffering. 8

b) Let G be a Context Free Grammar for which the production Rules are given below:

$S \rightarrow aB \mid bA$
$A \rightarrow a \mid aS \mid bAA$
$B \rightarrow b \mid bS \mid aBB$

Now, derive the string *aaabbabbba* from *S* using:

i. Leftmost derivation 3

ii. Rightmost derivation. 3

c) Consider the following grammar:

$S \rightarrow aSbS \mid bSaS \mid \varepsilon$

i. Show that the grammar is ambiguous (you may try with sentence *abab*). 3

ii. What language does the grammar generate? 3

d) What is the *configuration* of a table driven parser? What are it's uses? 5

B.Sc. Engg. 8th Semester (35) 19 November 2020

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **Summer SEMESTER, 2019-2020**
DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4835: Pattern Recognition

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer all of the questions. Figures in the right margin indicate marks.

(Any unfair mean like copying from slides/internet source, sharing answer scripts etc. will result into severe punishment.)

1. a) Suppose a dataset contains 10000 RGB images belonging to n different classes. A linear classifier was used to correctly classify these samples. To achieve better accuracy, K-fold cross-validation was performed. Each of the K-folds $(fold_1, fold_2, \ldots\ldots, fold_k)$ contained an equal number of images. 15
   Firstly $fold_1$ was considered as the test set, $fold_2$ as the validation set and all other $(k-2)$ folds as training set which led to the accuracy: $'acc_1'$. In the next iteration, $fold_2$ was considered as the test set, $fold_3$ as the validation set and all other $(k-2)$ folds as training set leading to another accuracy: $'acc_2'$. In this way, the test-set and validation-set were changed k times leading to k accuracies $(acc_1, acc_2, \ldots\ldots, acc_k)$. The final accuracy was claimed to be 95% by averaging all these acc_i values.
   Explain the effectiveness of this experimental method. How much can this result be trusted? Write your remarks with possible comments on improving the methodology (if any).
   b) How much does *K Nearest Neighbour* algorithm care about the semantic information of an image? How does that affect the overall result? How to improve? 7
   c) Define $'Hyperparameter'$. What can the Hyperparameters be in the context of Image classification with the *KNN* algorithm? 3
2. a) What is *Pattern Recognition* (PR)? Write three applications of PR is any domain. Briefly explain the properties that an efficient feature should hold for better recognition rate. 1+3 +6
   b) Suppose you are trying to build a Linear Classifier for *'Bangla Handwritten Digit Recognition'* which is a 10-class classification problem. The Linear classifier will produce a score based on the following function: 6+6

$$f(x, W) = Wx + b$$

   Here, W represents the weights, x is the input pixels and b represents bias terms for individual classes. Let's say the dimension of the input image is $(ID + 5) \times (ID + 10) \times 3$. [$'ID'$ is representing the last two digits of your student-ID]
   With proper justification, mention the suitable dimensions of W & b for this experiment. Explain the analogy of '*bias trick*' for adopting the bias terms within W & x to avoid the addition operation.
   c) Briefly explain *Figure-1* in the context of *Multi-Class SVM classifier*. 3

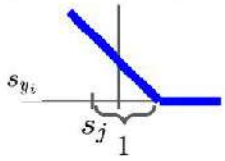

Figure 1: Hinge Loss

3. a) $Keywords$: $\{Score, Weight\ vector, Gradient\ Descent, Loss\ Function, Input\ data, Backpropagation, Regularization\}$ 15

Draw a proper flow-chart by arranging the *keywords* mentioned above according to their roles in solving a *classification problem*. Mention their roles & relation with each other properly in the chart.

b) 3+7

$$f(x,y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$$

Draw the *Computational Graph* representation of the above-mentioned function in the most granular fashion. Showing detailed calculations, find the gradients of the function f with respect to the variables (x_1, x_2, y_1, y_2) using the *Backpropagation algorithm*. Consider $(x_1, y_1) = (2,3)$ and $(x_2, y_2) = (1,7)$.