Name of the Program: B.Sc. in SWE **Date: 14 June 2021**
Semester: Winter 2020-2021 **Time: 2:30 pm – 4:00 pm**

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**
COURSE CODE: CSE 4501 (SWE) **FULL MARKS: 75**
COURSE TITLE: OPERATING SYSTEMS **DURATION: 1 Hour 30 Minutes**

CSE 4501 (SWE): Operating Systems

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

There are total **4 (FOUR)** questions each with one or more sub-questions. Answer **3** (**THREE**) of them. Answer any one from question **1 (ONE)** and **2 (TWO).** Question **3 (THREE)** and **4 (FOUR)** are compulsory. The symbols have their usual meanings.
Figures in the right margin indicate marks and corresponding CO and PO.

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1. a) "An operating system performs no useful function by itself. It provides the means for proper use of computer resources in the operation of the computer system." Justify the statement. — 10 — CO1 — PO1

   b) In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems. What are two such problems? Can we ensure the same degree of security in a time-shared machine as in a dedicated machine? Explain your answer. — 10 — CO1 — PO1

   c) Google's Chrome browser opens each new tab in a separate process. Would the same benefits have been achieved if Chrome opens each new tab in a separate thread? Explain your answer. — 5 — CO1 — PO2

2. a) Multi-programming (or multi-tasking) enables more than a single process to apparently execute simultaneously. How is this achieved on a uniprocessor? Discuss, with examples, how the problem of maintaining coherence of cached data manifests itself in a uniprocessor system? — 10 — CO1 — PO1

   b) Cooperating processes require an Inter-Process Communication (IPC) mechanism that will allow them to exchange data and information. There are two fundamental models of IPC: (1) Shared memory and (2) Message passing.

   Explain with examples when shared memory performs better than message passing. Also explain with examples, when message passing performs better than shared memory. — 10 — CO1 — PO1

c) It is sometimes difficult to achieve a layered approach if two components of the operating system are dependent on each other. Identify a scenario in which it is unclear how to layer two system components that require tight coupling of their functionalities. 5 CO1 PO2

3. a) Three kinds of threads share access to a singly-linked list: searchers, inserters and deleters. Searchers merely examine the list; hence they can execute concurrently with each other. Inserters add new items to the end of the list; insertions must be mutually exclusive to preclude two inserters from inserting new items at about the same time. However, one insert can proceed in parallel with any number of searches. Finally, deleters remove items from anywhere in the list. At most one deleter process can access the list at a time, and deletion must also be mutually exclusive with searches and insertions. 10 CO5 PO2

   Write pseudo code for searchers, inserters and deleters that enforces this kind of three-way categorical mutual exclusion using semaphores.

b) There are three kinds of threads: immigrants, spectators, and a one judge. Immigrants must wait in line, check in, and then sit down. At some point, the judge enters the building. When the judge is in the building, no one may enter, and the immigrants may not leave. Spectators may leave. Once all immigrants check in, the judge can confirm the naturalization. After the confirmation, the immigrants pick up their certificates of U.S. Citizenship. The judge leaves at some point after the confirmation. Spectators may now enter as before. After immigrants get their certificates, they may leave. 15 CO5 PO2

   Write pseudo code for immigrants, spectators, and the judge to be able to work without violating the task order outlined above. You can use Mutex Locks, Semaphores, or Monitors (any one) in your solution.

4. a) Company A wants to install multiple small servers for its databases. For installing those servers, the company has planned to introduce a dedicated Operating System (OS). Company A has hired you to develop such OS for the company. 7 CO2 PO2

   - The OS will only be used to install the servers.
   - Servers may be installed at different physical locations.

   As an OS developer, your task is to choose between Uniprocessor and Multiprocessor OS. Which OS will you choose? Explain your answer in the following aspects:

   - Ease of Programming
   - The need for Synchronization
   - Performance Evaluation

b) What will be the output at lines A, B, C and D? (*Assume that the process, executing the following lines of code with process ID 2540, creates a process with process ID 2545.*) 8 CO2 PO2

```
#include<sys/types.h>
#include<stdio.h>
#include<unistd.h>
#include<sys/wait.h>

int main()
{
    pid_t pid, pid1;
    /* fork a child process */
    pid = fork();
    if (pid < 0) { /* error occurred */
        fprintf(stderr, "Fork Failed");
        return 1;
    }
    else if (pid == 0) { /* child process */
        pid1 = getpid();
        printf("child: pid = %d",pid); /* A */
        printf("child: pid1 = %d",pid1); /* B */
    }
    else { /* parent process */
        pid1 = getpid();
        printf("parent: pid = %d",pid); /* C */
        printf("parent: pid1 = %d",pid1); /* D */
        wait(NULL);
    }
    return 0;
}
```

c) The Windows operating system is an example of modern design that employs modularity to increase functionality and decrease the time needed to implement new features. Windows provides support for multiple operating environments, or subsystems, with which application programs communicate via a message-passing mechanism. The message-passing facility in Windows is called the Local Procedure-Call (LPC) facility. It is similar to the standard RPC mechanism that is widely used, but it is optimized for and specific to Windows. The application programs can be considered clients of the Windows XP subsystem server.

10
CO2
PO2

Make a note on how LPC is different from Standard RPC and also point out similarities between them. Is it possible to use standard RPC instead of LPC to get similar performance in windows? Explain your answer.

Name of the Program: B.Sc. in Software Engineering	20 June 2021
Semester: Winter 2020-2021	Time: 2:30 pm – 4:00 pm

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

Mid Semester Examination	Winter Semester: 2020-2021
Course Number : Math 4543 Course Title : Numerical Analysis Methods	Full Marks: 75 Time: 1.5 Hours

There are **3 (three)** questions. Answer all of them. Figures in the right margin indicate marks. The examination is **Online** and **Close Book**. Marks of each question and corresponding **CO** and **PO** are written in the brackets. Write **Student ID** and **Name** top of the **first page** and write **student ID** and **page no** in every page of the answer script. Submission pdf of the answer script should be named as **Full_Student_ID<space>Course Code.pdf**

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1. a) Why would you use relative approximate error instead of relative absolute error in numerical analysis methods? Also explain the scenario where you do vice-versa with appropriate scenario. — 5+6 (CO1) (PO1)

   b) If one chooses 8 terms of the Maclaurin series for e^x to calculate $\mathbf{e^{0.8}}$, how many significant digits can you trust in the solution? Find your answer without knowing or using the exact answer. — 6 (CO1) (PO1)

   c) Given the following function — 8 (CO1) (PO1)

$$f(x) = \frac{e^x - e^{-x}}{x}$$

   Use three-digit rounding arithmetic to evaluate $f(0.1)$

2. a) State Taylor's theorem and mention three of its applications. With the help of Taylor's theorem, find out the value of $f(4.25)$ given that $f(4) = 125$, $f'(4) = 74$, $f''(4) = 30$, $f'''(4) = 6$ and all other higher derivatives of $f(x)$ at x = 4 are zero. — 4+6 (CO1) (PO1)

   b) The Taylor series for e^x at point $x = 0$ is given by — 4+3 (CO3) (PO1)

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \frac{x^5}{5!} + \ldots$$

   a) What is the truncation (true) error in the representation of $e^{1.0}$ if only four terms of the series are used?

   b) Use the remainder theorem to find the bounds of the truncation error.

   c) Explain the drawbacks of Bisection method for solving nonlinear equations. Use figures if necessary. — 8 (CO1) (PO3)

3. a) Solve the following fourth-degree polynomial with the help of Secant method within the ranges of [-1, 0] and [0, 1]. — 6 (CO2) (PO1, PO2)

$$f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

   b) Approximate $f(0.43)$ using the following data and the Quadratic Newton divided difference method formula: — 9 (CO2) (PO1, PO2)

x	0.0	0.2	0.4	0.6	0.8
$f(x)$	1.00000	1.22140	1.49182	1.82212	2.22554

   c) How can you find out 3n number of unknowns for quadratic spline interpolation? — 10

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MID TERM EXAMINATION **WINTER SEMESTER, 2020-2021**

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

SWE 4501: Design Patterns

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.
Submission pdf of the answer script should be named as **Full_Student_ID<space>Course Code.pdf**

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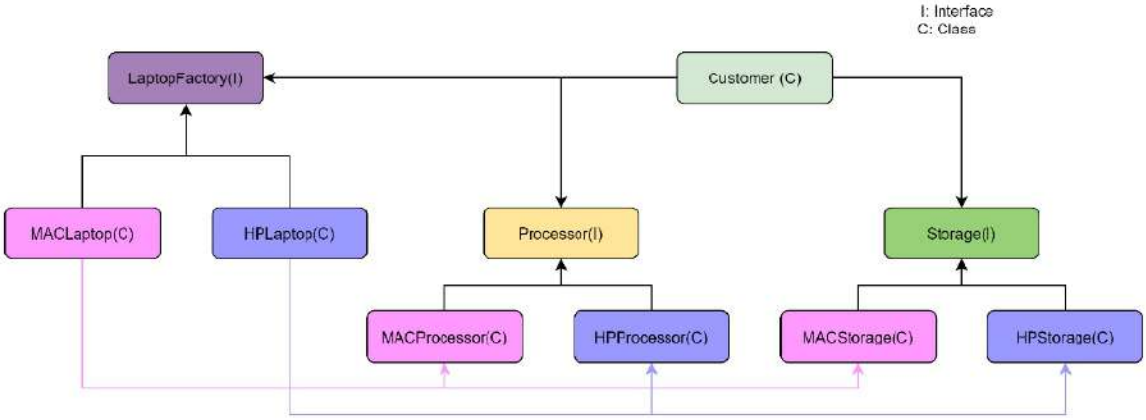
1. (a) What is Design Pattern? What are the different categories of design pattern? Explain the advantages of design pattern. — 6 (CO1) (PO1)

   (b) Explain the following statements with examples. — 9 (CO1) (PO1)
   - i. Class vs. interface inheritance.
   - ii. Program to an interface, not an implementation.
   - iii. Favor object composition over inheritance.

   (c) Consider an electronics shop where a customer can buy two brand laptops (MAC, HP) with different storage size. The detailed structure is presented in the following. Solve this scenario using a design pattern with corresponding code. — 10 (CO4) (PO1,PO2)



2. (a) Briefly, explain the purpose of the singleton pattern. Write different ways to work with singleton class in multithreaded environment. — 5 (CO2) (PO2)

   (b) For each part, write down the name of the design pattern with justification that would be most useful for addressing the situation described. — 2×5 (CO3) (PO2,PO3, PO4,PO12)
   - i. You are going to see the beauty of the world. You have a plan to capture the beauty through mobile and save it to laptop. You know that different countries have different standards to measure electric socket, volt, and frequency. For example, USA (Type A/B, 120V, 60Hz), UK (Type G, 230V, 50Hz).
   - ii. Hot fudge, the best ice cream toppings, makes the ice cream world colder than it was. It makes any flavor taste like a million bucks. Even, mixing a specific topping multiple times makes the ice cream tastier.

iii. By pressing the start button, a computer is needed to be started. We really do not care what all things go inside the computer hardware and software (load installed programs, drivers etc.).

iv. Imagine a system where a client gets information by performing a query on various databases such as hsql db and oracle db. The query is encapsulated by binding together a set of actions on a specific receiver (hsql/oracle). The system has the facility to undo a query that was last executed.

v. In any company, it is common to generate different reports on different formats. Assume a report generate that will generate two types of reports: tax and expense report. To generate a specific report, a series of procedures are needed to be followed: Tax report (Oracle db connection, perform a query to get tax related information and convert the information to a CSV format), Expense report (MySQL db connection, perform a query to get expense related information and convert the information to a PDF format).

(c) Why does factory method call creational design pattern? Briefly explain that pattern with example. Also discuss the advantages and disadvantages of that pattern. 10 (CO1) (PO1)

3. (a) Explain a scenario where observer pattern can be used. Write the corresponding code for the solution on that scenario. Also, draw the UML diagram for that scenario. 10 (CO2) (PO2)

(b) Match each pattern with its description with brief justification (write like 1+i : justification). 1.5×10 (CO4) (PO1,PO3)

Design pattern	Description
1) Decorator	i) Wraps an object and provides a different interface to it.
2) Façade	ii) Subclasses decide how to implement steps in an algorithm.
3) Strategy	iii) Subclasses decide which concrete classes to create.
4) Factory method	iv) Ensures one and only object is created.
5) Adapter	v) Encapsulates interchangeable behaviors and uses delegation to decide which one to use.
6) Observer	vi) Simplifies the interface of a set of classes.
7) Template method	vii) Wraps an object to provide new behavior.
8) Singleton	viii) Allows a client to create families of objects without specifying their concrete classes.
9) Abstract factory	ix) Allows objects to be notified when state changes.
10) Command	x) Encapsulate a request as an object.

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MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**

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

SWE 4503: Software Security

Answer all **three (3)** questions.

Figures inside the boxes in right margin indicate marks of each question. The square brackets on the start of each question denotes the corresponding CO(s) and PO(s).

The name of the answer script must be in the following format <**StudentID CourseCode MID.pdf**>.

N.B. *If it becomes evident that you have copied any answer from any other source without prior instruction, evaluators can reject that answer altogether at the time of evaluation.*

1. a) [(CO1), (PO2), (PO4)] Clarify the concept of following terms **with appropriate examples**. 8
   i. Software Security
   ii. Web Security
   iii. Network Security
   iv. Cyber Security

   b) [(CO1), (PO2), (PO4)] Consider a telephone switching system that routes calls through a switching network based on the telephone number requested by the caller. Now, explain the following terminologies for this telephone switching system. 7
   i. Asset
   ii. Vulnerability
   iii. Threat
   iv. Attack

   c) [(CO1), (PO2), (PO4)] Consider an automated teller machine (ATM) in which users provide a personal identification number (PIN) and a card for account access. Give **examples of confidentiality, integrity,** and **availability** requirements associated with the system and, in each case, indicate the **degree of importance** of the requirement. 10

2. Consider a simple web application for employee management in an NGO which is **vulnerable to *SQL injection* attack.** There are mainly two roles in this web application: Administrator is a privilege role and can manage each individual employees' profile information; Employee is a normal role and can view his/her own profile information.

   a) [(CO1), (PO2), (PO4)] Your first task as an attacker, is to **log into** the web application **as the administrator** from the login page, so you can see the information of all the employees. The login page depicted in Figure-1 asks for username and password. 14

   The data used by this application is stored in a MySQL database which have a designated table to store the credential and personal information of administrator and every employee. The **name of that particular table and its column fields** are **completely unknown to you.**

i) Since the **credential of the administrator is unknown to you**, hence to get this information, you have to successfully execute few more SQL queries by exploiting this vulnerable application. To accomplish this task, you have to **proceed on assumption in finding** the **target table** and **its column fields**.
Note: (If the web app is vulnerable to SQL injection, then there are queries you can use to know the ***RDBMS Metadata***.)

ii) Consider the username and encrypted version password of the administrator are available to you. Now, you need to decide what to type in the Username and Password fields to log into the web application as the administrator.

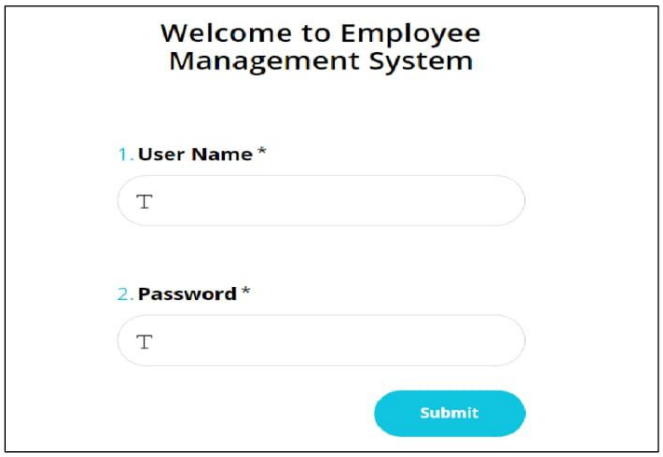

Figure-1: Login page of the application

b) [(CO1), (PO2), (PO4)] After the successful completion of question-1(a), now the credential and personal information of every employee should be available to you. The Table-1 displays the content of target table named *User_info* containing credential and personal information of each employee of the NGO. 7

The application has an *Update Employee Profile* page shown in Figure-2 that allows administrator to **update** the ***email and phone number*** of any employee by mentioning appropriate *U_ID*. However, the administrator is not authorized to change the *NID* (national identification number) of any employee. When administrator update any employee's information through the *Update Employee Profile* page, the *unsafe_update_backend.php* file is used to update employee's profile information. The content of the *unsafe_update_backend.php* file is not available to you and it doesn't have any protection against SQLi attack. Hence, you have to guess the content of this *PHP* file.

i) Now, you as an attacker want to change Bob's *NID* (national identification number) to something that you know. Please demonstrate how you can achieve that.

Table 1: User Information from Table *User_Info*

User_Name	***U_ID***	***User_Pass***	***User_NID***	***User_Email***	***User_Phone***
Sys_Admin	9999	As373dr3jytZ	2029853001	admin@org.ti	0187652354
Alice	1000	BjrC53H87CJ	1543098533	alice@org.ti	0165467345
Bob	2000	JXtSr3r3jytZh	4329854164	bob@org.ti	0198745357
Samy	3000	B43YVFAUR	1265734037	samy@org.ti	0187643746
Hasan	4000	Ncery37BCJY	9761650551	hasan@org.ti	0187734783
Ahamd	5000	74Tb54vdr437	1207588074	ahad@org.ti	0167438478

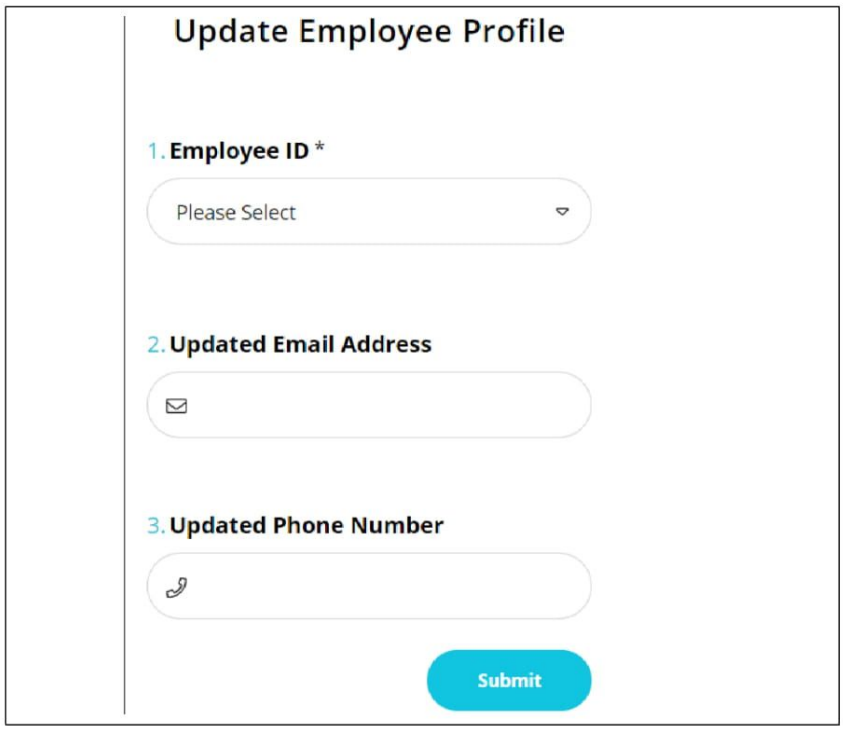

Figure-2: Update employee profile page of the application

c) [(CO2), (PO1), (PO3), (PO5)] Briefly discuss the fundament cause and solution of ***SQLi*** (***SQL injection) attack***. 4

3. a) [(CO1), (PO2), (PO4)] Discuss the technical detail of ***Session Hijacking*** with the aid of an **example scenario**. 9

b) [(CO1), (PO2), (PO4)] Clarify the concept of ***Cross-Site Scripting*** (***XSS) based Phishing attack*** with the aid of an **example scenario**. Technical justification should be included. 9

c) [(CO2), (PO1), (PO3), (PO5)] Discuss the role of ***Session Management*** in preventing ***Broken Authentication attack***. 4

d) [(CO4), (PO6)] List the potential impacts of ***Cross-Site Scripting (XSS) attack.*** 3

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MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**

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

SWE 4537: Server Programming

Programmable calculators are not allowed.

Figures in the right margin indicate marks. You need to answer all three questions.
Write Student ID and Name top of the first page and write studentID and page no in every page of the answer script.
Submission pdf should be named as Full_Student_ID<space>Course_Code<dot>pdf

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1. a) Describe the differences between different types of Browser Storage. **9** (CO1,PO1)

b) Explain the working mechanism of Web Applications with necessary diagrams. Describe HTTP Request and Response format. **6+4** (CO1,PO1)

c) Why do we know HTTP as a stateless protocol? ***http://www.blissfair.com:77?userID=123&theme=light%20grey*** – Explain the different parts of this URL. **3+3** (CO1,PO1)

2. a) What is OAuth V2.0? Explain its working procedure with the help of necessary diagrams. **7** (CO2,PO1,PO5)

b) Define the structure of JWT. Explain the working procedure of JSON Web Token based authentication. **7** (CO2,PO1,PO5)

c) What are the differences between SOAP and RESTful Web Services? **5** (CO2,PO1,PO5)

d) Write short description about the following terms- **2+2+2** (CO2,PO1,PO5)

I. CSRF
II. XSS
III. Middleware

3. In our society, the number of people who read/write/is involved with literature is decreasing day by day. For these people, you want to create a separate platform where they can share their thoughts on various topics related to literature. It might be a review of a book, thoughts on the current condition of Bengali literature, discussion on the lifestyle of a renowned writer, etc. So, you want to create a blog for book readers or writers.

It will use Express JS for Backend. Users will be authenticated with their email and password. In the homepage, users will be able to see posts from other users. And there will be a section to create a new post on the homepage. For every post, users can like/comment on the post. Commenting on the post will take the user to a separate page where all the comments regarding that post will be shown and there'll be a section to post new comments. There'll be a profile page where information regarding the current user will be shown.

a) Define the routes and controller functions you need to create for the user authentication of this app. You can assume that necessary view files such as 'login.html', 'register.html', 'home.html', etc. are already created. **6+6** (CO3,PO1,PO2, PO3,PO5,PO6)

b) Describe the differences between synchronous and asynchronous functions with example. **5** (CO3,PO1,PO2, PO3,PO5,PO6)

c) Define a middleware with the corresponding route for validating form response during user registration request. It will check if password is at least 8 characters or not. If the validation fails user will be redirected to Registration route. Otherwise, user account will be created (using a dummy registerUser function) and user will be redirected to Home route. **8** (CO3,PO1,PO2, PO3,PO5,PO6)

B.Sc. Engg. CSE 7th Sem
B.Sc. Engg. SWE 5th Sem

24 June 2021

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**

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

CSE 4559 / CSE 4749: Introduction to Cloud Computing

There are **3 (three)** questions. Answer **all** of them. Figures in the right margin indicate marks. The examination is **Online and Close Book**. Marks of each question and corresponding CO and PO are written in the brackets.

Write **Student ID** and **Name** top of the first page and write **student ID** and **page no** in every page of the answer script. Submission pdf of the answer script should be named as **Full_Student_ID<space>CourseCode.pdf**

1	a)	Mr X has a host machine that has 128 GB RAM and He is trying to used virtualization and create as many virtual machines as He possibly can. The VMs that He wants to create requires 6 GB RAM but only uses 4 GB RAM. How can Mr X maximize the number of VMs His host machine can support? Calculate the amount of memory that will be saved by Mr X if you used memory overcommit?	10 (CO2) (PO2)
	b)	Traditional IT infrastructure are usually faced with problems such as under provision and low utilization. Illustrate these problems with the help of diagrams. How does Cloud Computing resole such problems in the IT infrastructure?	10 (CO3) (PO2)
	c)	Describe the different Cloud Service Models	5 (CO1) (PO1)
2.	a)	What is virtualization? Differentiate between para virtualization and full virtualization.	5 (CO1) (PO1)
	b)	Write short notes on the following. i. Cloud Deployment Models ii. Issues of Cloud Computing	10 (CO1) (PO1)
	c)	Discuss the significance of hypervisors in Cloud Computing.	6 (CO1) (PO1)
	d)	How does the different inbound rules add security to your cloud environment in Microsoft Azure	4 (CO2) (PO2)
3.	a)	TechMonitor Inc. is a local startup that has been asked by the city to monitor and record near misses and accidents between cars, bicyclists and pedestrians all the time. TechMonitor Inc. is planning to deploy video cameras and dedicated computing at each busy intersection in the city. Since the bandwidth from the intersection to the cloud is limited, TechMonitor Inc. plans to process the streams of data at the intersection to identify near misses and accidents. They will then send the data for just the "interesting" cases to the cloud for storage and potential further analysis. We know that cloud computing offers various benefits and features to users. For each benefit listed below, indicate whether you believe it would be important to TechMonitor Inc. and describe why	10 (CO3) (PO3)

i. VM Elasticity
ii. No upfront cost
iii. Reduced IT maintenance

b) Elaborate on the following type of VM migration. Discuss their downtime and migration duration. 9 (CO2) (PO1)
i. Stop-and-copy (S-C)
ii. Demand-migration (D-M)
iii. Iterative precopy (I-P)

c) Victor, the old man in your engineering team says that geographically triplicated data centers ensure that if one data center is partitioned from the others, then users connected to the data centers that can communicate will continue to receive service. You, the young intern from IUT, reply that this is not the most important reason for geo-replication in the Cloud Computing services world. Give at least one reason that you might argue is more important than availability during partition and explain how you defend this reason. 6 (CO3) (PO3)