Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
SWE 3rd Year 1st Semester Final Examination' Jun 2022 (Session: 2019-20)
Course Code: SWE 327   Credits: 3   Course Title: Database Management System
Time: 3 hrs   Total Marks: 60

Group A
[Answer all the questions]

5x1=5

1. **Answer any FIVE**
   a) What are the appropriate primary keys in the Worker_Info schema in Figure 1?
   b) Given your choice of primary keys, identify appropriate foreign keys in the Worker_Info schema in Figure 1
   c) What are the appropriate primary keys in the Restaurant_Info schema in Figure 2?
   d) Given your choice of primary keys, identify appropriate foreign keys in the Restaurant_Info schema in Figure 2.
   e) Is it possible to keep null values in the serves relation in Restaurant_Info database?
   f) Differentiate between Dense and Sparse Index.
   g) What are the level of data abstraction? Illustrate.

2. **Considering the Worker_Info Database, Write any four queries in SQL from the following.**   4x2.5=10

> Employee (EMPLOYEE_ID, FIRST_NAME, LAST_NAME, SALARY, JOINING_DATE, DEPARTMENT)
> Bonus (EMPLOYEE_REF_ID, BONUS_AMOUNT, BONUS_DATE)
> Title (EMPLOYEE_REF_ID, EMPLOYEE_TITLE, AFFECTED_FROM)

Figure 1: Worker_Info Database

   a) Write SQL script to add a column in the Worker table named DESCRIPTION.
   b) Write an SQL query to fetch unique values of DEPARTMENT from Worker table.
   c) Find all WORKER_ID with a SALARY value greater than BDT50,000.
   d) Find all Worker with a BONUS_AMOUNT value greater than BDT30,000 in the year of 2020.
   e) What is a LOCK in database? Why it is used? Write about different types of LOCK.
   f) Count the number of employees of HRM department in Worker_Info database.

3. **Answer the following questions.**   2x7.5=15

   3x2.5=7.5

   a)
   > restaurant(rid, rname, rcity, phone, seat-capacity)
   > dishes(did, dname, dtype)
   > customer(cid, cname, ccity)
   > serves(rid, did)

   Figure 2: Restaurant_Info Database

   Consider the Restaurant_Info schema and write SQL to answer any three from the following questions.
   i. Find the appropriate primary key and foreign from the above database.
   ii. Find those restaurants that serve 'Kala Bhuna';
   iii. Update all customer's city with 'Cumilla' who lives in 'Comilla';
   iv. List all available food items in 'Dhaka City.
   v. Add a food item named 'Mas Bhorta' with the type 'Bhorta'. You may consider a conventional ID for this food item.

b)
```
Suppliers(sid integer, sname string, address string)
Parts(pid integer, pname string, color string)
Catalog(sid integer, pid integer, cost real)
```

Figure 3: Supplier_Info Database

Consider the **Supplier_Info Database** schema and write SQL query to answer the following questions (any **three**)

i Find the names of suppliers who supply some red parts.
ii Find the sids of suppliers who supply some red or green parts.
iii Find the cost of the parts named "SPOKE"
iv Find the supplier list of Sylhet
v Show the catalogue of "STEERING WHEEL 303"

3x2.5=7.5

Group B
[Answer all the questions]

4. **Answer any FIVE**   5x1=5
a) When does starvation occur?
b) What is a Wait-for graph?
c) Why do database systems support concurrent execution in transactions, in spite of the extra programming effort needed to ensure that concurrent execution does not cause any problems?
d) What is the Isolation requirement of a transaction?
e) What are transitive functional dependencies?
f) Compare 3NF with BCNF.
g) What is a generalization in DBMS?

5. **Answer any FOUR**   4x2.5=10
a) Compare the Ordered Indexing with Hashing.
b) Explain different transaction states with an appropriate diagram.

c) What are Lock-Based Protocols? Explain two kinds of Lock-Based Protocols.
d) Explain some deadlock prevention strategies.
e) How can we recover a deadlock when it is detected?
f) What are some disadvantages of using distributed database system architecture?

6. **Answer any THREE**   3x5=15
a)
People's Park Kyebando is located in Kampala district along Kampala –Gayazard and was licensed by KCCA in 2009. It's located 1 mile from Kalwere round about, People's Park Kyebando is constructed on 1 Acre of land (measurements 100ft-100ft) in Kyebando village, it provides enough space for its well-wishing customers, It is equipped with high maximum security coupled with an electric fence, four gun men from a well training security company and well trained bull dogs have been also used to control trespassing within the People's Park and with this maximum security, expenses like compensation of customers' lost vehicles are brought down.

People's Park Kyebando had challenges concerning its safety of data in the store since they currently use paper based system, physical struggle for parking by drivers, wastage of time, congestion and collision. There was also a problem of monitoring the profit made for the company where by the company was losing money to its workers who receive the money (fraud). This system majorly solved the congestion, collision and save time during parking activities.

Now, design an Entity Relationship Diagram for "Online Vehicle Parking Reservation System (OVPRS)" that enables customers/drivers to reserve a parking space. It also allows the customers/drivers to view the parking status at Kyebando People's Park. It is also helps to avoid the congestion and collision of the vehicle. The main objective of this project is to enable drivers to locate and reserve a parking place online through accessing it on web platform.

b)

FULL NAMES	PHYSICAL ADDRESS	MOVIES RENTED	SALUTATION
Janet Jones	First Street Plot No 4	Pirates of the Caribbean, Clash of the Titans	Ms.
Robert Phil	3rd Street 34	Forgetting Sarah Marshal, Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

Figure 4: Movie_Rented Table

Consider the table shown in figure 4, convert the table in:
  i. 1NF
  ii. 2NF
  iii. 3NF

c) What is 2PC? Why it is needed during the transaction in Distributed Database Architecture?

d) Explain the insertion technique in B^+ Tree with an example.

e) Let T_1 transfer \$50 from A to B, and T_2 transfer 10% of the balance from A to B. Consider schedule 1 and schedule 2 shown in figure 5 and figure 6 respectively, Do you think the sum A + B is preserved in both cases? Explain.

T_1	T_2
read (A)	
A := A − 50	
write (A)	
	read (A)
	temp := A * 0.1
	A := A - temp
	write (A)
read (B)	
B := B + 50	
write (B)	
commit	
	read (B)
	B := B + temp
	write (B)
	commit

Figure 5: Schedule 1

T_1	T_2
read (A) 100	
A := A − 50	
	read (A) 100
	temp := A * 0.1 10
	A := A - temp 90
	write (A) 90
	read (B) 100
write (A) 50	
read (B) 200	
B := B + 50 50	
write (B) 250	
commit	
	B := B + temp 210
	write (B)
	commit 210

Figure 6: Schedule 2

100
200

50+2

Group A
[Answer all the questions]

**1. Answer any FIVE**   5x2=10

a) What is the hamming distance between 1001 and 0001?

b) A network with bandwidth of 20 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network?

c) How many links are there for n devices in a star topology? Draw star topology connected with 4 devices.

d) What is the difference between **error checking** in the Data link layer and Transport layer?

e) Name two Application layer protocols with their purposes.

f) What is DNS? In which layer does it work?

g) An analog signal carries 4 bits per signal element. What is the bit rate, if 1000 signal elements are sent per second?

h) What is the purpose of GET message of HTTP protocol?

2. Answer any FOUR   4x5=20

a) What happens when a web address is typed into a web browser? Briefly explain the steps to open a web page in a browser.

b) What are the results of scrambling the sequence 111000001 using the following scrambling techniques? Assume that the last non-zero signal level has been positive.
   i)   B8ZS
   ii) HDB3 (The number of nonzero pulses is odd after the last substitution)

c) Why do we need **port addressing**? State the range of valid port numbers.

d) Briefly describe the responsibilities of data link sublayers.

e) Consider the 3-way handshake protocol shown in the figure. Fill up the values of missing fields.
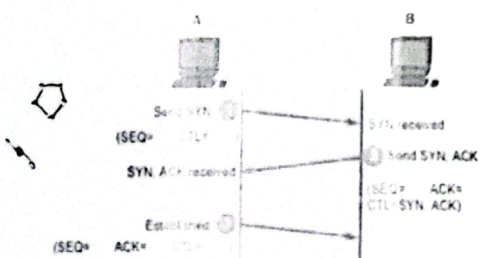
f) Show the leasing operation between a DHCP client and DHCP server with a figure and briefly write the function of each message.

3. Answer any TWO   2x10=20

a) What are the advantages of using VLAN? Describe different VLAN types with their applications.

b) Suppose your organization uses the network ID of 172.100.0.0/16. The network needs to be partitioned into 11 subnets. Answer the following questions:
   i.   For the subnets, how many bits must be borrowed from the host address bits?
   ii.   What is the subnet mask for these subnets?
   iii. What is the CIDR notation for the last (11th) subnet's network ID?

   What is the range of host addresses for the last (11th) subnet?

c) Encode the bit stream 01110111101111 using MLT-3 and Differential Manchester.

Group B
[Answer all the questions]

5x2=10

4. **Answer any FIVE**
    a) Define **Intranets** with example.
    b) What is the difference between **connectionless** and **connection-oriented** protocols? Give two examples of each.
    c) State the benefits of using a layered model?
    d) What are the private IP address ranges defined in RFC 1918?
    e) If a periodic composite signal has five sine waves with frequencies of 200, 400, 550, 700, and 900 Hz, what is its bandwidth? Draw the spectrum if the amplitudes are 5V, 5V, 10V, 5V and 5V, respectively.
    f) What are the features of a default gateway?
    g) What are the loopback addresses? For which purpose loopback address is used?
    h) Write down the benefits of segmenting networks in subnets.

4x5=20

5. **Answer any FOUR**

    a) Write the basic functions of ARP. What are the issues with ARP?
    b) Write down the basic operations of **TCP**.
    c) Briefly describe the primary functions of **Presentation layer**.
    d) Define unicast, broadcast and multicast with examples.
    e) Describe the **Host Forwarding Decision** technique.
    f) Explain how CSMA/CD resolves collision problem.

2x10=20

6. **Answer any TWO**   7+3

    a) i) What is the function of NAT? Explain the benefits and risks of using NAT in LAN. How does PAT differ from NAT?
        ii) What is the difference between static NAT and static PAT?
    b) Briefly describe the four basic characteristics of a reliable network.
    c) i) Write down the purposes of the **Session layer** in OSI model.
        ii) Draw the frame format of Data link layer. Describe any two fields of a frame.

Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
Software Engineering
1st Year 1st Semester Final Examination 2022 (Session: 2019-20)
Course Code: SWE323   Credit: 3   Course Title: Artificial Intelligence
Time: 3 hours   Total Marks: 100

Group A
[Answer all the questions]

1.   Answer any FIVE   5x2=10

a) What is artificial intelligence?

b) Explain the following agent type: Goal-based, Utility-based

c) What are the components of an AI system?

d) What is overfitting? How can it be overcome in Machine Learning?

e) Define CSP in AI with example

f) Why do we study game playing in AI?

2.   Answer any FOUR   4x5=20

a) What is PEAS(Performance, Environment, Actuators, Sensors)? Explain with examples for the TESLA Autopilot car.

b) Briefly discuss different types of agents with example.

c) Explain the mechanism of A* Search.

d) Briefly describe the uninformed search methods.

e) Suppose there is a population of army personnel of two regions A : B = 1 : 20. Twelve percent of the people from region A and thirty percent of the people from region B get a chance in the UN peace program every year. Now, if we choose a person who got a chance in the UN peace program, what are the chances that he is from region A?

3.   Answer any TWO   2x10=20

a) What are the assumptions of a blocks world environment? Suppose a robot hand can perform the following four actions: UNSTACK(x, y), STACK(x, y), PICKUP(x) and PUTDOWND(x). Find the solution for moving the blocks from the given initial state to the goal state.

C		D
A		B

Initial State

B		D
A		C

Goal State

b) What is a heuristic? Design and heuristic function and solve the given 8-puzzle.

1	2	3
8	5	6
4	7	

Initial State

1	2	3
4	5	6
7	8	

Goal State

c) Consider the following graph:
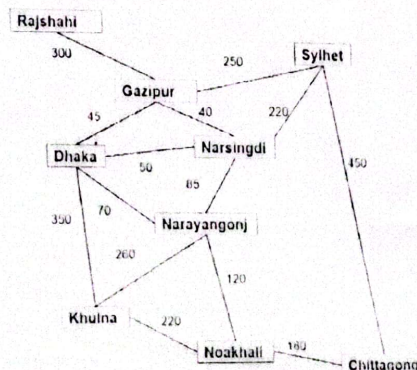
Start - > Sylhet
Goal - > Khulna

Heuristic h(n)

h (Sylhet) = 530
h (Rajshahi) = 520
h (Gazipur) = 300
h (Dhaka) = 350
h (Narsingdi) = 320
h (Narayangonj) = 260
h (Chittagong) = 390
h (Khulna) = 0
h (Noakhali) = 220

Find the most cost-effective path to reach from start state Sylhet to final state khulna using A* algorithm.

250+45+350
220+85+260

Group B
[Answer all the questions]

4.   Answer any FIVE   5x2=10

a) Differentiate between informed and un-informed search.
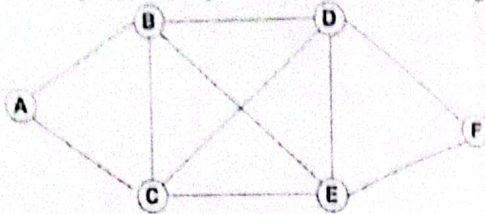
b) What are the drawbacks of hill climbing search.

e) Write the difference between UCS and DLS ✓
f) Define the search problem in AI ✗
g) Give a brief introduction to the Turing test AI ✓
h) What is heuristic search? ✓

5. **Answer any FOUR**   4×5=20

a) Define in your own words the following terms: agent, agent function, agent program, rationality and autonomy.

b)

Apply BFS on node B. Show the steps.

c) Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP search.

d) Given the following, can you prove that the unicorn is mythical?
If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

f) Write short notes on the informed search methods.

6. **Answer any TWO**   2×10=20

a)   3+5+2
   i. Using Min-max approach, fill up the blank nodes in the given game tree with appropriate values.
   ii. Prune the tree using alpha-beta cutoffs.
   iii. Is Min-max BFS or DFS? Why?
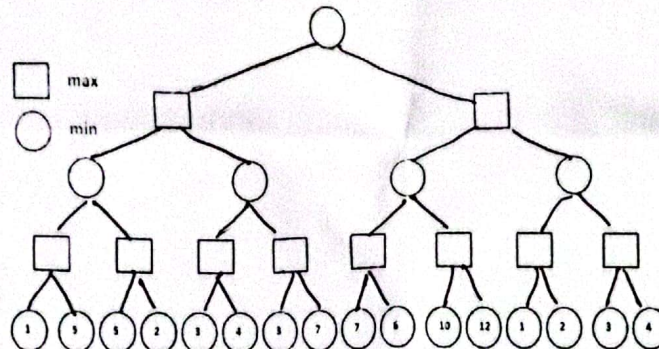
b) Suppose a genetic algorithm uses chromosomes of the form X = abcdefgh with a fixed length of eight   4+4+2
genes. Each gene can be any digit (0-9). The fitness of an individual x is calculated as $f(x) = (a - b) + (c - d) + (e - f) + (g - h)$.
The initial population consists of four individuals with the following chromosomes:
   $X_1 = 6 5 4 1 3 5 3 2$
   $X_2 = 2 3 9 2 1 2 8 5$
   $X_3 = 4 1 8 5 2 0 9 4$
   $X_4 = 8 7 1 2 6 6 0 1$
Perform the following crossover operations:
   i.   Cross the fittest two individuals using one-point crossover at the middle point.
   ii. Cross the 2nd and 3rd fittest individuals using a two-point crossover (after genes b and f, i.e. ab|cdef|gh).
   iii. Has the fitness improved in new generation?
Find the maximum possible fitness score for the given model.

c) Make a decision tree for the given data; show all the calculations and draw the final tree.

Color	Shape	Category
Red	Round	C1
Red	Square	C2
Green	Round	C1
Blue	Round	C1
Blue	Square	C3
Green	Square	C4

Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
Software Engineering
3rd Year 1st Semester Final Examination' July 2023 (Session: 2019-20)
Course Code: SWE 321   Credits: 3   Course Title: Software Architecture & Design Pattern
Time: 3 hrs   Total Marks: 60

Group A
[Answer all the questions]

1.   Answer any FIVE   5x1=5

a)   Explain Pull up field and Collapse Hierarchy.

b)   What are the classifications of design patterns? Name two patterns in each class.

c)   What is *tightly coupled* code?

d)   What is the purpose of *Unified Modeling Language* (UML)?

e)   What do you understand by the term *Feature Envy* in Code smell?

f)   Describe the purpose of using Singleton Pattern.

g)   What is the motivation for the *Iterator* design pattern?

2.   Answer any FOUR   4x2.5=10

a)   What is the *Refused Bequest* code smell? Which SOLID principle does that code smell violate? Explain with an example.

b)   In a game development context, which design pattern can be utilized to represent and manage reusable game objects such as bullets or particles? Discuss in brief.

c)   Draw the software architecture of an ATM System.

d)   How can the use of inheritance contribute to achieving compliance with the Open-Closed Principle? Discuss in brief.

e)   Briefly describe the *Master-Slave* architecture with its components.

f)   *Singleton* and *Flyweight* design patterns seem to be alike when it comes to memory saving and optimization. Can you identify what are the dissimilarities between them?

3.   Answer any THREE   3x5=15

a)   Suppose you are making a text data reader system. This system intended to read large amounts of data such as 8GB data files. You want your system to read all the data at a time and handle optimized memory usage.

Design the above mentioned system with appropriate design patterns. Draw the class diagram and write the code to support your design.

b)   Suppose you are developing software for an aircraft control tower to manage the runways. The aircrafts must communicate through the control tower to have the runways clear for safe landing. So you decided to use the *Mediator* pattern to design the system. Your team lead told you that you need to use the *Pub-Sub* system too. Can you guess the scenario where you need to use it? Draw the UML diagram for both of the design patterns for the aircraft landing management system.

Consider you are designing a user interface toolkit that supports multiple look-and-feel for iOS and Android applications. Different look-and-feels define different appearances and behavior for user interface "widget" like scroll bars, buttons, text fields. To be portable across look-and-feels standards, an application should not hard code its widgets for a particular look-and-feel. Instantiating look-and-feel-specific classes of widgets throughout the application make it hard to change the look and feel later.

State a pattern that can help achieve this scenario. Draw the UML diagram for it.

c)   Consider a class *"TCPconnection"* that represents a network connection. A *"TCPconnection"* object can be in one of several different states: Established, Listening and Closed. When a *"TCPconnection"* object receives requests from other objects, it responds differently depending on its current state. For example, the effect of an Open request depends on whether the connection is in its Closed state or its Established State.

Based on this behavior, state a solution applying appropriate design pattern. Mention the participants for the pattern and write pseudo code for it.

1

Group B
[Answer all the questions]

4. Answer any FIVE   5x1=5

a) Write the participants of the *Facade* design pattern.

b) What do you understand by the term *Speculative Generality* in code smell?

c) What is a *Stateful Server*?

d) "Mediator design pattern is a Structural design pattern." - true or false?

e) "Talk to the interface, not to the concrete class" ---Explain the statement with appropriate reasoning.

f) What is the intent of the *Proxy* design pattern?

g) Give two examples of *Interface Definition Language (IDL)*.

h) What do you understand about the term *"Clean Code"*?

5. Answer any FOUR   4x2.5=10

a) What is the motivation behind the Adapter design pattern? Draw a UML diagram for the pattern and explain its participant.

b) What is the motivation behind the Memento pattern? Draw the UML or class diagram for a memento pattern. Identify the participants and their roles from the diagram.

c) Name two different patterns that used to eliminate if-else statements in code? Give an example of each of these two patterns explaining how these patterns help eliminate if-else statements.

d) Can the Builder pattern be used to create immutable objects? Yes or No? If yes, explain with an example.

e) How does the Dependency Inversion Principle promote loose coupling between software components? Discuss in brief.

f) What is the Model-View-Controller (MVC) design pattern, and what are its main components?

6. Answer any THREE   3x5=15

a) Imagine you are designing a framework for building different types of reports (e.g., PDF, CSV, HTML). How can the *Template Method* design pattern be applied to handle the common structure of generating reports while allowing flexibility for specific report formats? Write the UML diagram and the pseudo code for that scenario.

b) We are supposed to create a computer game that has several scenarios. African scenario, Asian scenario, American Scenario. Each scenario has the following components: 1 terrain, 5 trees of the same kind and 2 animals of the same kind. For each scenario, we have different kinds of terrain, trees and animals. To draw the scenario, we just need to draw the components of a scenario.

Design the above mentioned system with the appropriate design pattern. Draw the class diagram and write the code to support your design.

c) What approach would you take to design a banking system where transaction requests follow a hierarchical flow, starting from lower-level authorizers and progressing to higher-level authorizers until the appropriate level of authorization is reached, ensuring that each level has the authority to approve or reject the transaction based on their specific authorization limits? Mention the design pattern you might follow and write the pseudo code to support your design.

d) In a music streaming application, different audio formats (such as MP3, FLAC, and WAV) need to be played using different decoding algorithms. How can you design the system to dynamically select the appropriate decoding algorithm based on the audio format, allowing for easy addition of new formats and decoding algorithms in the future? Mention the design pattern you may follow along with the pseudo code of the design.