

ST. MARY’S UNIVERSITY
UNDERGRADUATE DEGREE PROGRAMME
COMPUTER SCIENCE
COMPREHENSIVE DEGREE COMPUTER SCIENCE
MOCK EXIT EXAMINATION
(CDEE)

Date: May, 2015 G.C/ Ginbot 2007E.C.

Time Allowed 3:00 hrs.

Instructions

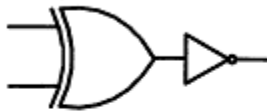
- **This examination is for final year undergraduate Computer Science degree students.**
- **This Examination has two parts (Part-I-Multiple Choice and Part II Workout Questions)**
- **Read the instruction for each part very carefully and respond to all questions accordingly**
- **Make sure that the exam has 65 Multiple Choice and 13 Short Answer questions.**
- **The mock examination is for practice. Therefore, put yourself under examination conditions and do the exam within the above given time. Check your answers against the answer key found at the end so as to rate yourself, only after you have done the exam.**
- **Make sure that this examination has 27 pages.**

Part One. Multiple Choice Questions (1pt. each) (65 Points)

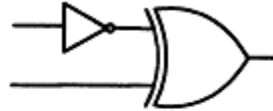
Choose the best answer from the given alternatives.

1. Which one of the following circuits is **not** equivalent to a 2-input XNOR (exclusive NOR) gate?

A.



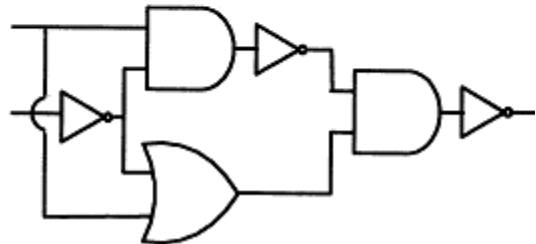
C.



B.



D.



2. A thread is usually defined as a 'light weight process' because an Operating System (OS) maintains smaller data structures for a thread than for a process. In relation to this, which of the followings is true?

- A. On per-thread basis, the OS maintains only CPU register state
- B. The OS does not maintain a separate stack for each thread
- C. On per-thread basis, the OS does not maintain virtual memory state
- D. On per thread basis, the OS maintains only scheduling and accounting information

3.The lexical analysis for a modern computer language such as Java needs the power of which one of the following machine models in a necessary and sufficient sense?

- A. Finite state automata
- B. Deterministic pushdown automata
- C. Non-Deterministic pushdown automata
- D. Turing machine

4.Let P be a regular language and Q be a context free language such that $Q \subseteq P$. (For example, let P be the language represented by the regular expression p^*q^* and Q be $\{p^n q^n \mid n \in \mathbb{N}\}$). Then which of the following is always regular?

A. $P \cap Q$

C. $\Sigma^* - P$

B. $P - Q$

D. $\Sigma^* - Q$

5.In a compiler, keywords of a language are recognized during

- A. parsing of the program
- B. the code generation
- C. the lexical analysis of the program
- D. dataflow analysis

6.A layer-4 firewall (a device that can look at all protocol headers up to the transport layer) **cannot**

- A. block entire HTTP traffic during 9:00PM and 5:00AM
- B. block all ICMP traffic
- C. stop incoming traffic from a specific IP address but allow outgoing traffic to the same IP address
- D. block TCP traffic from a specific user on a multi-user system during 9:00PM and 5:00AM

7.Which one of the following pairs has **different** expressive power?

- A. Deterministic finite automata (DFA) and Non-deterministic finite automata (NFA)
- B. Deterministic push down automata (DPDA) and Non-deterministic push down automata (NPDA)
- C. Deterministic single-tape Turing machine and Non-deterministic single tape Turing machine
- D. Single-tape Turing machine and multi-tape Turing machine

8.HTML (Hyper Text Markup Language) has language elements which permit certain actions other than describing the structure of the web document. Which one of the following actions is **not** supported by pure HTML (without any server or client side scripting) pages?

- A. Embed web objects from different sites into the same page
- B. Refresh the page automatically after a specified interval
- C. Automatically redirect to another page upon download
- D. Display the client time as part of the page

9.Which one of the following is **not** desired in a good Software Requirement Specifications (SRS) document?

- A. Functional Requirements
- B. Non Functional Requirements
- C. Goals of Implementation
- D. Algorithms for Software Implementation

10. Which one of the given options provides the increasing order of asymptotic complexity of functions f_1 , f_2 , f_3 and f_4 ?

$$f_1(n) = 2^n; f_2(n) = n^{3/2}; f_3(n) = n \log_2 n; f_4(n) = n^{\log_2 n}$$

- | | |
|-------------------------|-------------------------|
| A. f_3, f_2, f_4, f_1 | C. f_2, f_3, f_1, f_4 |
| B. f_3, f_2, f_1, f_4 | D. f_2, f_3, f_4, f_1 |

11. Which one of the following is true?

- A. Every relation in 3NF is also in BCNF
- B. A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R
- C. Every relation in BCNF is also in 3NF
- D. No relation can be in both BCNF and 3NF

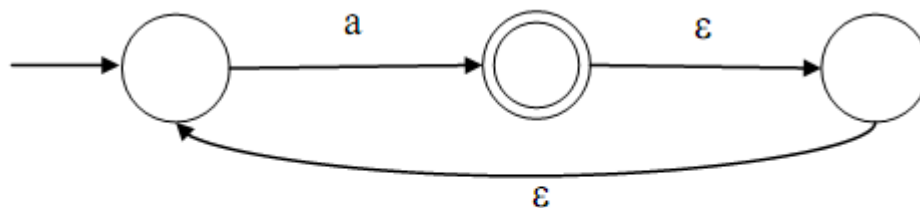
12. What will be the output of the following program segment?

```
Char inChar = 'A' ;  
switch (inChar ) {  
    case 'A' : printf ("Choice A\n");  
    case 'B' :  
    case 'C' : print f("Choice B");  
    case 'D' :  
    case 'E' :  
    default : printf ("No Choice") ; }
```

- A. No choice
- B. Choice A

- C. Choice B
- D. Choice C

13. What is the complement of the language accepted by the NFA shown below? Assume $\Sigma = \{a\}$ and ϵ is the empty string?



- A. \emptyset
- B. $\{\epsilon\}$

- C. a^*
- D. $\{a, \epsilon\}$

14. Given the basic ER and relational models, which of the following is **incorrect**?

- A. An attribute of an entity can have more than one value
- B. An attribute of an entity can be composite
- C. In a row of a relational table, an attribute can have more than one value
- D. In a row of a relational table, an attribute can have exactly one value or a null value

15. Let $W(n)$ and $A(n)$ denote respectively, the worst case and average case running time of an algorithm executed on an input of size n . Which of the following is always true?

- | | |
|--------------------------|---------------------|
| A. $A(n) = \Omega(W(n))$ | C. $A(n) = O(W(n))$ |
| B. $A(n) = \Theta(W(n))$ | D. $A(n) = o(W(n))$ |

16. The amount of ROM needed to implement a 4 bit multiplier is

- | | |
|-------------|------------|
| A. 64 bits | C. 1 Kbits |
| B. 128 bits | D. 2 Kbits |

17. Which one of the following transport layer protocols is used to support electronic mail?

- | | |
|---------|--------|
| A. SMTP | C. TCP |
| B. IP | D. UDP |

18. In the IPv4 addressing format, the number of networks allowed under Class C addresses is

- | | |
|-------------|-------------|
| A. 2^{14} | C. 2^{21} |
| B. 2^7 | D. 2^{24} |

19. Which one of the following problems is decidable?

- | | |
|---|------------|
| 1) Does a given program ever produce an output? | |
| 2) If L is a context-free language, then, is L also context-free? | |
| 3) If L is a regular language, then, is L also regular? | |
| 4) If L is a recursive language, then, is L also recursive? | |
| A. 1, 2, 3, 4 | C. 2, 3, 4 |
| B. 1, 2 | D. 3, 4 |

20. Given the language $L = \{ab, aa, baa\}$, which one of the following strings are in L^* ?

- | | |
|-----------------|---------------|
| 1) abaabaaabaa | |
| 2) aaaabaaaa | |
| 3) baaaaabaaaab | |
| 4) baaaaabaa | |
| A. 1, 2 and 3 | C. 1, 2 and 4 |
| B. 2, 3 and 4 | D. 1, 3 and 4 |

21. Consider the following transactions with data items P and Q initialized to zero:

```
T1 :read (P);  
    read (Q);  
    if P = 0 then Q := Q + 1 ;  
    write (Q).  
T2 : read (Q);  
    read (P);  
    if Q = 0 then P := P + 1 ;  
    write (P).
```

Any non-serial interleaving of T1 and T2 for concurrent execution leads to

- A. a serializable schedule
- B. a schedule that is not conflict serializable
- C. a conflict serializable schedule
- D. a schedule for which a precedence graph cannot be drawn

Consider the 3 processes, P1, P2 and P3 shown in the table to answer question 22 below.

Process	Arrival time	Time Units Required
P1	0	5
P2	1	7
P3	3	4

22. The completion order of the 3 processes under the policies FCFS and RR2 (round robin scheduling with CPU quantum of 2 time units) are

- A. FCFS: P1, P2, P3 RR2: P1, P2, P3
- B. FCFS: P1, P3, P2 RR2: P1, P3, P2
- C. FCFS: P1, P2, P3 RR2: P1, P3, P2
- D. FCFS: P1, P3, P2 RR2: P1, P2, P3

23. An Internet Service Provider (ISP) has the following chunk of CIDR-based IP addresses available with it: 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to Organization A, and a quarter to Organization B, while retaining the remaining with itself. Which one of the following is a valid allocation of addresses to A and B?
- A. 245.248.136.0/21 and 245.248.128.0/22
 - B. 245.248.128.0/21 and 245.248.128.0/22
 - C. 245.248.132.0/22 and 245.248.132.0/21
 - D. 245.248.136.0/24 and 245.248.132.0/21
24. Suppose a circular queue of capacity $(n - 1)$ elements is implemented with an array of n elements.

Assume that the insertion and deletion operations are carried out using REAR and FRONT as array index variables, respectively. Initially, REAR = FRONT = 0.

The conditions to detect queue full and queue empty are

- A. full: $(\text{REAR} + 1) \bmod n == \text{FRONT}$
empty: $\text{REAR} == \text{FRONT}$
- B. full: $(\text{REAR} + 1) \bmod n == \text{FRONT}$
empty: $(\text{FRONT} + 1) \bmod n == \text{REAR}$
- C. full: $\text{REAR} == \text{FRONT}$
empty: $(\text{REAR} + 1) \bmod n == \text{FRONT}$
- D. full: $(\text{FRONT} + 1) \bmod n == \text{REAR}$
empty: $\text{REAR} == \text{FRONT}$

Consider the following relations A, B and C:

A		
Id	Name	Age
12	Arun	60
15	Shreya	24
99	Rohit	11

B		
Id	Name	Age
15	Shreya	24
25	Hari	40
98	Rohit	20
99	Rohit	11

C		
Id	Phone	Area
10	2200	02
99	2100	01

25. How many tuples does the result of the following SQL query contain?

```
SELECT A.Id
FROM A
WHERE A.Age > ALL (SELECT B.Age
                    FROM B
                    WHERE B.Name = 'Arun')
```

A. 4

C. 0

B. 3

D. 1

Statement for Questions 26 and 27:

For the grammar below, a partial LL(1) parsing table is also presented along with the grammar. Entries that need to be filled are indicated as E1, E2, and E3. ϵ is the empty string, \$ indicates end of input, and, | separates alternate right hand sides of productions.

$S \rightarrow a A b B \mid b A a B \mid \epsilon$

$A \rightarrow S$

$B \rightarrow S$

	a	b	\$
S	E1	E2	$S \rightarrow \epsilon$
A	$A \rightarrow S$	$A \rightarrow S$	error
B	$B \rightarrow S$	$B \rightarrow S$	E3

26. The FIRST and FOLLOW sets for the non-terminals A and B are

A. $\text{FIRST}(A) = \{a, b, \varepsilon\} = \text{FIRST}(B)$

$\text{FOLLOW}(A) = \{a, b\}$

$\text{FOLLOW}(B) = \{a, b, \$\}$

B. $\text{FIRST}(A) = \{a, b, \$\}$

$\text{FIRST}(B) = \{a, b, \varepsilon\}$

$\text{FOLLOW}(A) = \{a, b\}$

$\text{FOLLOW}(B) = \{\$\}$

C. $\text{FIRST}(A) = \{a, b, \varepsilon\} = \text{FIRST}(B)$

$\text{FOLLOW}(A) = \{a, b\}$

$\text{FOLLOW}(B) = \emptyset$

D. $\text{FIRST}(A) = \{a, b\} = \text{FIRST}(B)$

$\text{FOLLOW}(A) = \{a, b\}$

$\text{FOLLOW}(B) = \{a, b\}$

27. The appropriate entries for E1, E2, and E3 are

A. E1: $S \rightarrow aAbB$, $A \rightarrow S$

E2: $S \rightarrow bAaB$, $B \rightarrow S$

E3: $B \rightarrow S$

B. E1: $S \rightarrow aAbB$, $S \rightarrow \varepsilon$

E2: $S \rightarrow bAaB$, $S \rightarrow \varepsilon$

E3: $S \rightarrow \varepsilon$

C. E1: $S \rightarrow aAbB$, $S \rightarrow \varepsilon$

E2: $S \rightarrow bAaB$, $S \rightarrow \varepsilon$

E3: $B \rightarrow S$

D. E1: $A \rightarrow S$, $S \rightarrow \varepsilon$

E2: $B \rightarrow S$, $S \rightarrow \varepsilon$

E3: $B \rightarrow S$

28. A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every T time units and decides the next process to schedule. Which one of the following is true if the processes have no I/O operations and all arrive at time zero?

This algorithm is equivalent to the

- A. first-come-first-serve algorithm.
- B. round-robin algorithm.
- C. shortest-job-first algorithm.
- C. shortest-remaining-time-first algorithm.

29. The transport layer protocols used for real time multimedia, file transfer, DNS and email, respectively are

- A. TCP, UDP, UDP and TCP
- B. UDP, TCP, TCP and UDP
- C. UDP, TCP, UDP and TCP
- D. TCP, UDP, TCP and UDP

30. Using public key cryptography, X adds a digital signature σ to message M, encrypts $\langle M, \sigma \rangle$, and sends it to Y, where it is decrypted. Which one of the following sequences of keys is used for the operations?

- A. Encryption: X's private key followed by Y's private key; Decryption: X's public key followed by Y's public key
- B. Encryption: X's private key followed by Y's public key; Decryption: X's public key followed by Y's private key
- C. Encryption: X's public key followed by Y's private key; Decryption: Y's public key followed by X's private key
- D. Encryption: X's private key followed by Y's public key; Decryption: Y's private key followed by X's public key

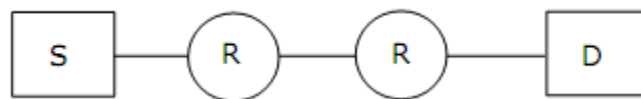
31. What is the return value of $f(p,p)$, if the value of p is initialized to 5 before the call? Note that the first parameter is passed by reference, whereas the second parameter is passed by value.

```
int f (int &x, int c) {  
    c = c - 1;  
    if (c==0) return 1;  
    x = x + 1;  
    return f(x,c) * x; }
```

- A. 3024
B. 6561
C. 55440
D. 161051
32. The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42.

Which one of the following is the postorder traversal sequence of the same tree?

- A. 10, 20, 15, 23, 25, 35, 42, 39, 30
B. 15, 10, 25, 23, 20, 42, 35, 39, 30
C. 15, 20, 10, 23, 25, 42, 35, 39, 30
D. 15, 10, 23, 25, 20, 35, 42, 39, 30
33. Assume that source S and destination D are connected through two intermediate routers labeled R . Determine how many times each packet has to visit the network layer and the data link layer during a transmission from S to D .



- A. Network layer – 4 times and Data link layer-4 times
B. Network layer – 4 times and Data link layer-3 times
C. Network layer – 4 times and Data link layer-6 times
D. Network layer – 2 times and Data link layer-6 times

34. The smallest integer than can be represented by an 8-bit number in 2's complement form is

- A. -256
- B. -128
- C. -127
- D. 0

35. CSS (Cascading Style Sheets) is used to specify the look of a Web page. Which one of the following methods embeds an external CSS in an HTML document?

- A. `<link rel="stylesheet" href="styles/global.css">`
- B. `<p style="color: red; font-size: 14pt;">This is red text at 14pt.</p>`
- C. `HTML comes close; CSS hits it right on!`
- D. `<style type="text/css">`
`<!--`
`body {background-color: white; font-size: 16pt;}`
`h1 {color: red;}`
`/* other style rules here */`
`-->`
`</style>`

36. Which one of the following web technologies is best for client side validation?

- A. Php
- B. SQL
- C. JavaScript
- D. ASP.NET

37. A type of site where content is relatively fixed, and users are unable to affect the look or scope of the data is:

- A. Dynamic site
- B. Static site
- C. Intranet site
- D. Extranet site

38. Which one of the following statements is **wrong** about the errors that we may encounter in a program?

- A. The compiler can detect syntax errors.
- B. The kinds of errors that the computer system can detect only when a program is run are called run-time errors.
- C. If the compiler approves of your program and there are no runtime errors, but the program does not perform properly, then undoubtedly your program contains a logic error.
- D. If a program is diagnosed as having run-time errors, the compiler cannot create an executable file.

39. What is happening in the computer when a variable is declared?
- A. Memory is allocated for a value of the specified type,
 - B. The variable's name is associated with the address of that memory
 - C. Memory is initialized with values provided in the declaration, if any.
 - D. All of the above.
40. Suppose that a variable is declared in a function definition and then another variable of the same name is also declared in the main part of the program (or in the body of some other function definition). Given this scenario, which of the following statements is **false**?
- A. These two variables are two different variables, even though they have the same name.
 - B. These two variables are the same variables; as a result the compiler will generate an error since the same variable is declared twice.
 - C. Variables that are declared within the body of a function definition are said to be local to that function or to have that function as their scope.
 - D. Variables that are defined within the main body of the program are said to be local to the main part of the program or to have the main part of the program as their scope.
41. Which one of the following is a correct statement about function overloading?
- A. It makes the programmer to think up a new name for a function.
 - B. In order to tell which function definition to use, the compiler checks the number of arguments and the types of the arguments in the function call.
 - C. When you give two (or more) function definitions different function names that is called overloading the function name.
 - D. When you overload a function name, the two definitions of the function name must have the same signatures using this definition of signature.

42. Which one of the following is not the characteristics of file I/O?

- A. During file I/O the program outputs data to screen and inputs data from keyboard.
- B. Files provide us with a way to store data permanently.
- C. An input file can be used over and over again by many programs without the need to type in the data separately for each program.
- D. Files provide you with a convenient way to deal with large quantities of data.

43. Choose the correct statement

- A. Every if statement must have a corresponding else.
- B. The expression: `(ch >= 'A' && ch <= 'Z')` evaluates to false if either `ch < 'A'` or `ch >= 'Z'`.
- C. The while loop:
 `j = 0;`
 `while (j <= 10)`
 `j++;`
 terminates if `j > 10`.
- D. When a while loop terminates, the control first goes back to the statement just before the while statement, and then the control goes to the statement immediately following the while loop.

44. Which one of the following statements is true about functions?

- A. A value-returning function can return more than one value at the same time.
- B. Parameters allow you to use different values each time the function is called.
- C. After a return statement executes, the statements after the return statements, if any, can be executed.
- D. A value-returning function returns only integer values.

45. Choose the **wrong** statement concerning exception handling

- A. The order in which catch blocks are listed is not important.
- B. An exception can be caught either in the function where it occurred or in any of the functions that led to the invocation of this method.
- C. The statements that may generate an exception are placed in a try block.
- D. A try block specifies the type of exception it can catch and contains an exception handler.

46. Given the statement `int myList[5];` choose the correct answer from the alternatives provided:
- A. The base address of the array `myList` is the value stored in the component `myList[0]`.
 - B. The statement `cout << myList << endl;` will output the value stored in `myList[0]`;
 - C. The statement `cout << myList << endl;` will output the value of `myList`, which is the base address of the array.
 - D. If you had the statement `int yourList[5];` execution of the statement: `if (myList <= yourList)` will generate error message.
47. Which one of the following is true about structures?
- A. Using a single structure variable it is possible to pass all the components as parameters to a function.
 - B. Arithmetic and relational operations are allowed on `struct(s)`.
 - C. A function cannot return a value of type `struct`.
 - D. Declaring `struct` variables during definition of the `struct` is illegal.
48. Which one of the following is a **wrong** statement regarding constructors?
- A. Like regular methods constructors can be overloaded.
 - B. Constructors play the role of initializing objects
 - C. Constructors are invoked using the `new` operator when an object is created
 - D. If you want to prohibit the user from creating an instance of a class you can use a public constructor
49. Which one of the following statements is **not correct** about a static method?
- A. Static members are associated with instances of a type.
 - B. A static method must be invoked using the class name.
 - C. Only a static method can modify a class variable.
 - D. Only a static method can access a class variable.
50. The process by which a new class— known as a derived class—is created from another class, called the base class is called _____.
- A. inheritance
 - B. structure
 - C. polymorphism
 - D. instantiation

51. The prototyping model of software development is

- A. a reasonable approach when requirements are well defined.
- B. a useful approach when a customer cannot define requirements clearly.
- C. the best approach to use for projects with large development teams.
- D. a risky model that rarely produces a meaningful product.

52. What is the normal order of activities in which traditional software testing is organized?

- a. integration testing
- b. system testing
- c. unit testing
- d. validation testing

- A. a, d, c, b
B. b, d, a, c

- C. c, a, d, b
D. d, b, c, a

53. Which one of these is objective for software testing?

- A. Determine the productivity of programmers
- B. Eliminate the need for future program maintenance
- C. Eliminate every error prior to release
- D. Uncover software errors

54. A generalized description of a collection of similar objects is a

- A. class
B. B. instance
C. subclass
D. super class

55. Polymorphism reduces the effort required to extend an object system by

- A. coupling objects together more tightly.
- B. enabling a number of different operations to share the same name.
- C. making objects more dependent on one another.
- D. removing the barriers imposed by encapsulation.

56. What activity does a software project manager need to perform to minimize the risk of software failure?
- A. Double the project team size
 - B. Request a large budget
 - C. Allow absolutely no schedule slippage
 - D. Define milestones and track progress
57. The project scope is defined as a means of bounding the system
- A. functionality and performance
 - B. staffing and skills
 - C. costs and resources
 - D. schedule and milestones
58. Software feasibility is based on which of the following?
- A. Business and marketing concerns
 - B. Scope, constraints, market
 - C. Technology, finance, time, resources
 - D. Technical prowess of the developers
59. Which one of the following scenarios may lead to an irrecoverable error in a database system?
- A. A transaction writes a data item after it is read by an uncommitted transaction
 - B. A transaction reads a data item after it is read by an uncommitted transaction
 - C. A transaction reads a data item after it is written by a committed transaction
 - D. A transaction reads a data item after it is written by an uncommitted transaction

60. Which one of the following best describes the difference between paging and segmentation?
- A. Paging breaks a process' virtual memory into physical units of the same size, whereas segmentation breaks a process' virtual memory into logical units that are typically of different sizes.
 - B. Paging suffers from external fragmentation, whereas segmentation suffers from internal fragmentation.
 - C. Paging requires page tables for address translation, whereas segmentation does not require segment tables for address translation.
 - D. Paging requires one page table per process, whereas segmentation requires only one global segment table for the entire system.
61. A starvation-free job-scheduling policy guarantees that no job waits indefinitely for service. Which of the following job-scheduling policies is starvation-free?
- A. Round-robin
 - B. Priority queuing
 - C. Shortest job first
 - D. Youngest job first
62. In multi programmed systems it is advantageous if some programs such as editors and compilers can be shared by several users. Which of the following must be true of multi programmed systems in order that a single copy of a program can be shared by several users? The program is
- A. a macro
 - B. Recursive
 - C. reentrant.
 - D. A & B
63. A privileged instruction may be executed only while the hardware is in kernel mode. Which of the following is **least** likely to be a privileged instruction?
- A. An instruction that changes the value of the program counter
 - B. An instruction that sends output to a printer
 - C. An instruction that modifies a memory management register
 - D. An instruction that halts the CPU

64. Which one of the following is **not** correct about knowledge base?
- A. A set of representation of facts and their relationships
 - B. The set of facts and relationships can be represented either FOL or PL language
 - C. In a declarative approach for building an agent, you can tell what the agent wants to know and ask it what it knows.
 - D. Answers from the agent can't be inferred from the knowledge base.
65. Which one of the following statements about fixed-length and variable-length instruction set architectures (ISAs) is (are) true?
- A. Variable-length ISAs allow for a smaller code size over fixed-length ISAs.
 - B. Fixed-length ISAs simplify instruction fetch and decode over variable-length ISAs.
 - C. Variable-length ISAs require more registers than fixed-length ISAs.
 - D. A & B

Part Two. Workout

Give short and precise answer for the following questions. (35 points)

The figure below shows a network path connecting a server to a client.



- 1) Referring to the above figure, answer the questions I, II and III below. (6 points)
 - I. What is the propagation delay for a packet going from the server to the client (you may assume that the speed of light is 200,000 km/s)?
 - II. What is the total transmission delay of a 10,000 bit packet on all of the links?
 - III. What is the average queuing delay at router X, assuming that the traffic intensity is 1.3 and the buffer can hold 10,000 packets and that the average packet size is 5,000 bits?
- 2) What are the differences between routing and forwarding? Please briefly explain each of them. (3 points)
- 3) During normal IP packet forwarding at a router, which the following packet fields are updated? (2 points)
- 4) What is the difference between Link-Layer and Transport-Layer reliable data transfers? (Hint: With the TCP reliable data transfer, why does the underlying link layer support data transmission reliability?) (3 points)
- 5) Briefly describe the similarity and differences between switches and routers. (3 points)
- 6) What is a collision domain? (Provide your answer associating it with switches and hubs). (2 points)
- 7) What are non-functional requirement for a software? (2 points)
- 8) Explain acceptance testing and beta testing. (3 points)
- 9) What is Object Oriented Programming (OOP)? What are the advantages of Object Oriented Programming? (2 points)
- 10) Briefly discuss the goals of normalization. (2 points)
- 11) What are the different problems that arise due to uncontrolled and concurrently running transactions in a database system? (3 points)

Consider the following function.

```
int f ()
{
    int k, result;
    result = 0;
    for ( k = 0; k < 5; k++ )
    {
        if ( ( k % 3 ) == 1 )
            result = result + k;
        else
            result = result + 1;
    }
    return result;
}
```

12) What value is returned as a result of the call to f () ? (2 points)

Consider the following pseudocode program.

```
main ()
begin
    integer a, b, c, i
    a = 6
    b = 7
    c = 8
    i = fun(a, b, c)
    print i, a, b, c
end

integer fun (integer x, integer y, integer z)
begin
    if (x > 6) then
        y = 25
        z = x + y
    return y + z
end
```

13) If fun uses call-by-reference, what values would be printed as a result of executing the pseudocode? (2 points)

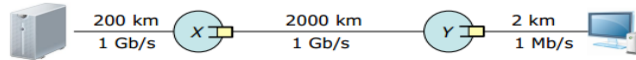
ST. MARY'S UNIVERSITY
UNDERGRADUATE DEGREEE PROGRAMME
COMPUTER SCIENCE
COMPREHENSIVE DEGREE COMPUTER SCIENCE
MOCK EXIT EXAMINATION
(CDEE)
ANSEWR KEY

1. D
2. A
3. A
4. C
5. C
6. A
7. B
8. D
9. D
10. A
11. C
12. C
13. B
14. C
15. C
16. D
17. C
18. C
19. D
20. C
21. B
22. C
23. A
24. A
25. B
26. A
27. C
28. B
29. C
30. D
31. B
32. D
33. C

34. B
35. A
36. C
37. B
38. D
39. D
40. B
41. B
42. A
43. C
44. B
45. D
46. C
47. A
48. D
49. A
50. A
51. B
52. C
53. D
54. A
55. B
56. D
57. A
58. C
59. D
60. A
61. A
62. C
63. A
64. D
65. D

Short answer questions (35 points)

The figure below shows a network path connecting a server to a client.



1) Referring to the above figure, answer the questions I, II and III below.

- I. What is the propagation delay for a packet going from the server to the client (you may assume that the speed of light is 200,000 km/s)?

Ans=1 ms + 10 ms + .01 ms = 11.01 ms

- II. What is the total transmission delay of a 10,000 bit packet on all of the links?

Ans=10 μs + 10 μs + 10 ms = 10.02 ms

- III. What is the average queueing delay at router X, assuming that the traffic intensity is 1.3 and the buffer can hold 10,000 packets and that the average packet size is 5,000 bits?

Ans=In this case, the queue will be nearly full all the time, so it takes about 10,000*5,000 ns or 50 ms for a packet to get to the front of the queue.

- 2) What are the differences between routing and forwarding? Please briefly explain each of them.

Ans :

Forwarding: move packets from router's input to appropriate router output.

Routing: determine route taken by packets from source to destination.

- 3) During normal IP packet forwarding at a router, which the following packet fields are updated?

Ans :

(c)TTL

(d)checksum

- 4) What is the difference between Link-Layer and Transport-Layer reliable data transfers? (Hint:

With the TCP reliable data transfer, why does the underlying link layer support data transmission reliability?)

Ans : Similar to transport –layer reliable delivery service, a link layer reliable delivery service is achieved with acknowledgements and retransmissions. ...A link layer reliable delivery service is often used for links that are prone to high error rates, such as a wireless link, with the goal of correcting an error locally—on the link where the error occurs—rather than forcing an end-to-end retransmission of the data by transport or application-layer protocol.

5) Briefly describe the similarity and differences between switches and routers.

Ans :

Sameness They are both store-and-forward devices.

Differences : But routers are network layer devices (examine network layer headers) and switches are link layer devices.

Routers maintain routing tables, implement routing algorithms

Switches maintain switch tables, implement filtering, learning algorithms

	<u>hubs</u>	<u>routers</u>	<u>switches</u>
traffic isolation	no	yes	yes
plug & play	yes	no	yes
optimal routing	no	yes	no
cut through	yes	no	yes

6) What is a collision domain? (Provide your answer associating it with switches and hubs).

Ans :

A collision will happen if node receives two or more signals at the same time.

Between the hub and the hosts that connect to the hub. In a single segment, the maximum node and its hub is 100 meters. All of the LAN segments belong to the same collision domain.

Whenever two or more nodes on the LAN segments transmit at the same time, there will be a collision. All of the transmitting nodes will enter exponential backoff. Individual segment collision domains become one large collision domain and bandwidth can not be aggregated

Switch installation breaks subnet into LAN segments

- ✧ switch filters packets:
- same-LAN-segment frames not usually forwarded onto other LAN segments
- ***segments become separate collision domains

7) What are non-functional requirement for software?

Ans,

Nonfunctional requirements are the characteristics of the system which can not be expressed as functions - such as the maintainability of the system, portability of the system, usability of the system, etc. Nonfunctional requirements may include:

- reliability issues,
- performance issues,
- human - computer interface issues,
- interface with other external systems,
- security and maintainability of the system, etc.

8) Explain acceptance testing and beta testing.

Ans. Acceptance Testing and Beta testing: System tests are designed to validate a fully developed system to assure that it meets its requirements.

Acceptance and beta testing are form of system testing:

- Beta testing. Beta testing is the system testing performed by a select group of friendly customers.
- Acceptance Testing. Acceptance testing is the system testing performed by the customer to determine whether he should accept the delivery of the system.

9) What is Object Oriented Programming (OOP)? What are the advantages of Object Oriented Programming?

Ans: Object Oriented Programming (OOP) is an approach that provides a way of modulating programs by creating partitioned memory area for both data and functions that can be used as templates for creating copies of such modules on demand.

The advantages of OOP are as follows:

- ✓ Function and data both are tied together in a single unit.
- ✓ Data is not accessible by external functions as it is hidden.
- ✓ Objects may communicate with each other only through functions.
- ✓ It is easy to add new data and functions whenever required.
- ✓ It can model real world problems very well.

10) Briefly discuss the goals of normalization.

Ans.

1. Minimize data redundancy, thereby avoiding anomalies and conserving storage space
2. Simplify the enforcement of referential integrity constraint
3. Make it easier to maintain data(insert, update, and delete)
4. Provide a better design that is an improved representation of the real world and a stronger basis for future growth

11) What are the different problems that arise due to uncontrolled and concurrently running transactions in a database system

Ans.

Lost update problem

Incorrect analysis

Uncommitted dependency

Consider the following function.

```
int f ()
{
    int k, result;
    result = 0;
    for ( k = 0; k < 5; k++ )
    {
        if ( ( k % 3 ) == 1 )
            result = result + k;
        else
            result = result + 1;
    }
    return result;
}
```

12) What value is returned as a result of the call to f () ?

Ans 8

Consider the following pseudocode program.

```
main ()
begin
    integer a, b, c, i
    a = 6
    b = 7
    c = 8
    i = fun(a, b, c)
    print i, a, b, c
end
integer fun (integer x, integer y, integer z)
begin
    if (x > 6) then
        y = 25
        z = x + y
    return y + z
end
```

13) If fun uses call-by-reference, what values would be printed as a result of executing the pseudocode?

Ans. I = 20 a = 6 b = 7 c = 13