2017

BM- (O) CS-11/17

COMPUTER SCIENCE - PAPER-II

Time Allowed : 3 Hours

Full Marks : 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in <u>English</u> or in <u>Bengali</u> but all answers must be in one and the same language.

Answer <u>Any Five</u> Questions from the following :

1. a)   What are classes and objects ? Illustrate.

   b)   Write a program in C++ which throws an exception of type char * and another type int. Write a try-catch block which can catch both the exception.

   c)   What happens in a while - loop if the control condition is false initially ?

   d)   What is dynamic initialization of objects ? Why is it required ? How is it accomplished in C++ . Illustrate.

   e)   What do you mean by protected accessibility ? Why is it needed ? Give Example.

   5+10+5+10+10

2. a)   Consider the following information about a University database.

   *   Professor have an empno, a name, a date of birth, a rank and a research speciality.

   *   Projects have a project-number, a sponsor name (e.g. UGC), a starting date, an ending date and a budget.

   *   Students have a registration number, a name, date of birth and course-name (e.g. 'Ph.D. in Computer Science').

   *   Each project managed by one Professor (Known as the 'Principle Investigator').

   *   Each Project is worked on by one or more Professor (Known as Co-investigator).

   *   Professors can manage and/or work on multiple projects.

   *   Each project is worked on by One or more students (Known as the Project's Research Assistant).

   *   When a student work on a project, a professor must supervise their work on the project.

   *   Department have a department-number, name and Location.

   *   Department have Professor who runs the department (Known as Head of the Department).

   i)   Draw an E - R diagram that capture the above information.

   ii) Translate this E - R diagram into a relational schema.

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b) Consider the following relations :

   Student (<u>rollno : integer</u>, Sname : String,
            major : string, age : integer)

   Class (<u>name : string</u>, scheduled_time : time,
          room : string, fid : integer)

   Erolled (<u>rollno : integer, Cname : string</u>)

   Faculty (<u>ficl : integer,</u> fname : string,
            deptid : integer)

The primary Keys are underlined. Write the following queries in SQL :

   i) Display the name of all students having 'Computer Science' major and enrolled in a class taught by 'A. K. Roy'.

   ii) Display the age of oldest student who is either a 'Computer Science' major or is enrolled in a course taught by 'A. K. Roy'.

   iii) Display the name of students who are enrolled maximum number of Classes.

   iv) Display the name of students who are not enrolled in any class.

5x4

3. a) Write a program with appropriate comments to evaluate the following arithmetic statement :

$$Y = \frac{A - B + C}{G + H}$$

   i) using an accumulator type computer with one-address instruction.

   ii) using zero-address instruction.

b) Explain the indirect address mode and how the effective address is calculated ? Illustrate with example.

c) What do you mean by "CPI" ? What is the approximate Value of CPI for a RISC processor.

d) In a sample machine with load-store architecture having clock rate 50 MHZ, let the instruction frequency be as follows for a program :

Operations	Frequency	No. of Clock cycles
A L U	40	1
Load	20	2
Store	10	2
Branch	30	2

Calculate MIPS for the machine.

10x4

4. a)   What is the cache coherence problem ? Suggest one method to solve this problem.

   b)   Give the hardware organization of associative memory, Why associative memory is faster then other memories. Deduce the logic equation used to find the match in the associative memory.

   c)   Consider a Cache (M_1) and memory (M_2) hierarchy with the following characteristics :

   M_1 :   16 K words, 50 ns access time

   M_2 :   1 M words, 400 ns access time

   Assume 8 words cache blocks and a set size of 256 words with set associative mapping.

   i)   Show the mapping between M_2 and M_1

   ii) Calculate the effective memory access time with cache.

   $\lfloor$ Given hit ratio   h = 0.95 $\rfloor$

   d)   A virtual memory system has an address space of 8K words and Page Block size of 1K words.

   The following page reference changes occur during a given time interval :

   4, 2, 0, 1, 2, 6, 1, 4, 0, 1, 0, 2, 3, 5, 7

   Determine the four pages that are resident in main memory after each page reference charge if the replacement algorithm used is   i) FIFO   ii) LRU   10x4

5. a)   What is the difference between Time-shariy and Batch system ?

   b)   Consider the following set of processes with corresponding arrival times and burst times :

Process	Arrival Time (Units)	CPU Burst Time (Units)
P1	0	6
P2	3	10
P3	5	8
P4	7	5
P5	10	6

   i)   Draw a Gantt chart considering Round Robin Schedules policy with time quantum = 4 units.

   ii) Calculate individual turnaround time and average waiting time.

   c)   Explain the working of first pass of assembler using flow chart.

   d)   Write a program in assembly language to subtract two integer numbers.   4+5+5+14+12

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6. a) Find the shortest path from A to D for the network shown below :
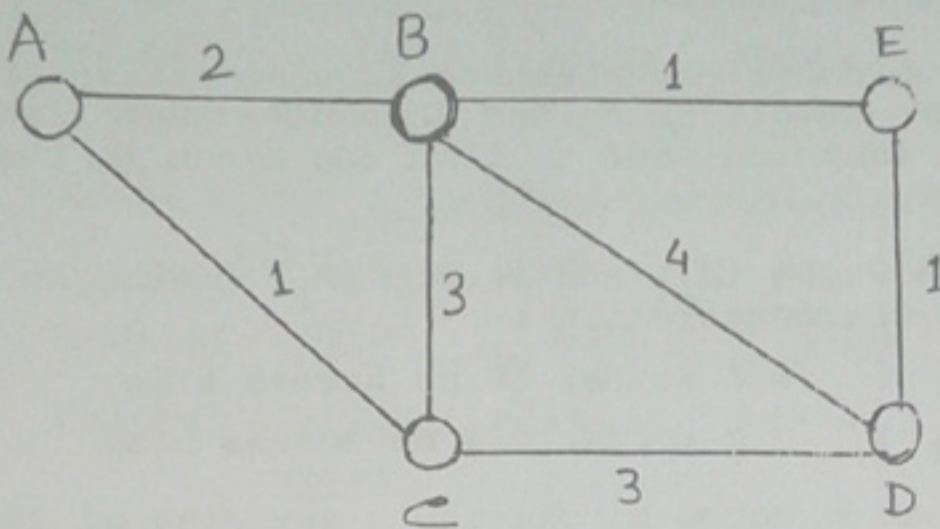
   b) How is subnet mask useful in IP addressing ? Explain with an example.

   c) If the address of a system is 221.46.75.64. Find network id, host id and class of network and network address.

   d) A class C network has IP address of a host as 198.123.46. 237. Four subnetworks are allowed for this network. What is the subnet mask, number of host per subnet and subnet address.

   e) Differentiate among economic feasibility Operational feasibility and technical feasibility in SDLC. Give example.

   f) What problems arise if two modules have high coupling ?

                                                      8+4+10+10+4+4

7. a) Explain how different phases of compilation Operate and converts following statement :

           pos   =   initial   +   rate   *   60

   assuning data type 'rate' is float.

   b) Define Finite state Automata (D‡A). Give example.

   c) Construct the transition diagram for the following regular expression :
        i)   (ab *) * .
        ii) ((a | b) c *) *
        iii) (a | b) * abb

   d) What are bitmap images ? What are the advantages and disadvantages of bit maps.

   e) Explain Bresenham's Line drawing procedure for lines with slopes > 1.

                                                      10+5+9+6+10