PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE -2020

SUBJECT: COMPUTER SCIENCE (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:

i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

Attempt Any FIVE Questions in All, Please attempt AT LEAST ONE Question from each Section

SECTION-A

Q No. 1: a) Convert the following Octal into equivalent Decimal, Hexadecimal and Binary number.

$(6412)_8$

b) Prove that the following proposition is a tautology by using truth table.

$[\neg p \wedge (p \vee q)] \rightarrow q$

(12 + 8 = 20 marks)

Q No. 2: Write a function in C/C++ that takes two integer arguments in the range [0 – 999]. The function calculates the sum of individual digits in each integer number and returns the integer whose sum is greater than the other. If the sum of both the integers is same, then return the first integer. For example, the sum of individual digits of the integer 219 is 2 + 1 + 9 = 12.
Use the following signature for the function:

int greater_sum (int n1, int n2) **(20 marks)**

Q No. 3: We have conducted a 5-mark quiz in a class of 300 students. The quiz has been marked. Each student's obtained marks are one of the numbers in the set {0, 1, 2, 3, 4, 5}. Write a function in C/C++ that takes, as argument, an unsorted list of obtained marks in the quiz and returns the marks that has the highest frequency. For example, if 20 students got 0 mark, 75 students got 1 mark, 40 students got 2 marks, 90 students got 3 marks, 60 students got 4 marks, and 15 students got 5 marks, then the function should return 3, since 3 marks has the highest frequency.
Use the following signature for the function:

int marks_mode (int marks[], int n) **(20 marks)**

SECTION-B

Q No. 4: Determine the latency (from first bit sent to last bit received) for each of the following:

i. 100-Mbps Ethernet with a single store-and-forward switch in the path and a packet size of 16,000 bits. Assume that each link introduces a propagation delay of 6 μs and that the switch begins retransmitting immediately after it has finished receiving the packet.
ii. Same as (i) but with three switches.
iii. Same as (i), but assume the switch implements "cut-through" switching; it is able to begin retransmitting the packet after the first 100 bits have been received.

(8 + 5 + 7 = 20 marks)

P.T.O

Q No. 5: A company is assigned the prefix 213.8.8.0/24. We are required to create subnets for the following four departments of the company.

Department	No. of hosts
A	90
B	30
C	25
D	20

i. Give a possible arrangement of subnets by specifying subnet number and subnet mask for each subnet.
ii. If the number of hosts in department A grows to 150 then what will be the possible arrangement of subnets. **(15 + 5 = 20 marks)**

Q No. 6:

a) Perform the following binary multiplication of the unsigned binary numbers.
11011×1010.
b) Perform the following binary division of the unsigned binary numbers.
$11110 \div 110$
c) Perform the following binary subtraction of the signed binary numbers.
$01011101 - 01001101$

(6 + 6 + 8 = 20 marks)

SECTION-C

Q No. 7: Write the algorithm of insertion sort. Also, show the operation of insertion sort on the following array.

12	9	11	13	8	10

(10+10=20 marks)

Q No. 8:

a) Differentiate between short-term, medium-term, and long-term scheduling.
b) Differentiate between user-level threads and kernel threads. Also, discuss pros and cons of each.
c) Differentiate between preemptive and non-preemptive scheduling.
d) How each of the following three scheduling algorithms treat short jobs?
   i. FCFS
   ii. RR
   iii. Multilevel feedback queues

(6 + 6 + 2 + 6 = 20 marks)

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COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE -2020

SUBJECT: COMPUTER SCIENCE (PAPER-II)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE:

i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
iv. Extra attempt of any question or any part of the question will not be considered.

Attempt Any FIVE Questions in All.

Question No: 1. **(4 x5=20)**

a) Third normal form argues that there should not be any transitive functional dependency. Discuss a real example scenario that shows transitive dependency problem.
b) Internet of Things is a modern technology that seems to impact several sectors. Discuss with a simple example scenario to show how can it help in managing agriculture?
c) Define wireless sensor networks? How can they be used in healthcare systems, explain with the help of a simple example?
d) Differentiate between two-tiered architecture with three-tiered architecture?

Question No: 2. **(2x10=20)**

a) Write a method in C++ or Java to calculate the power of a number. The input of the method should be a number n, and its power p. It should calculate n^p, e.g. if n = 5 and p = 3 then the function should return 5x5x5 = 125. Use the following prototype
   int power(int n, int p);
b) Write a function to find the second largest element from an integer array of size n. Use the following prototype:
   int secondLargest(int array[], int size);

Question No: 3. **(4x5=20)**

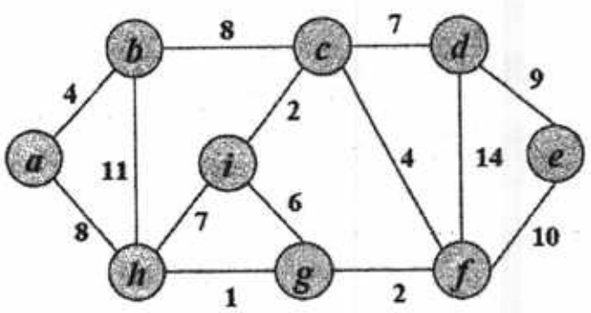
a) Differentiate between unit testing and integration testing?
b) Software architecture discusses the major components of a software system and their interaction with one-another. A good architecture encourages Low-Coupling and High-Cohesion. Explain these concepts of Low-Coupling and High-Cohesion with the help of an example system.
c) Facebook is an application that helps people become friends on the Internet. You are required to choose the best suitable data structure to manage the friendship relationships among different people. Which data structure would you choose and why?
d) Binary search trees are very efficient data structures which help inserting, deleting, and searching in lg(n) time. Where 'n' is the total number of nodes in a tree. In which situation they tend to exhibit 'n' time for searching and inserting instead of lg(n) time.

Question No: 4. Give short answers to the following questions: **(4x 5 =20)**

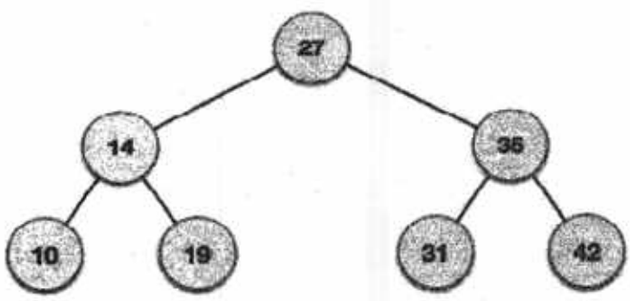
a) Differentiate between time division multiplexing and frequency division multiplexing?
b) What is 5G technology? Discuss any application area that can benefit from this technology.
c) Modern data centers use commodity machines to store and process information. However, these machines are not sophisticated enough to work in a reliable manner. This may result in unavailability of the system or data. How do the data centers handle this problem, discuss the pros and cons of their approach.
d) What is the difference between IPV4 and IPV6? How can IPV6 support in implementing IoT systems?

P.T.O

Question No: 5. a) Find the minimal spanning tree using Kruskal's algorithm. Show the order in which the edges will be added to the resultant tree. **(2x10=20)**



b) Give prefix, postfix, and infix expressions corresponding to the following tree



Question No: 6. **(5x4=20)**

i) Arrange the following in a memory hierarchy while showing their relative sizes, RAM, Hard Disk, Cache, Register, Tape storage.
ii) Explain the concept of semaphore, how does it help managing concurrent systems?
iii) Differentiate between a Process and a Thread?
iv) Page fault is a situation where the OS needs to load a page in the main memory. Some times this leads to the phenomenon of Thrashing. You are supposed to explain when and how Thrashing occurs?
v) What are the advantages of implementing stored procedures in implementation of a large scale system?

Question No: 7. Provide short answers to the following questions: **(4x5=20)**

a) How does Micro-service architecture help in software development and maintenance?
b) Write a piece of code that has lg(n) complexity.
c) How do you differentiate between a high level programming language and low level programming language?
d) Differentiate between a Deterministic Finite Automata and Non-Deterministic Finite Automata with the help of an example.

Question No: 8. **(2x10=20)**

a) We tend to remove anomalies while performing normalization in a database design. Insert, Delete, and Update are three types of anomalies. Explain them with the help of an example.
b) We can implement Facebook using the following tables.

User: userId, uname, password, ...
Post: postId, userId, time, postContent
Like: likeId, postId, time, userId
Comments: commentId, userId, commentText, time
CommentLike: commentLikeId, commentId, time, userId

However, this design may not work well when we have a huge userbase i.e. our registered users go beyond 1Billion users. In this case, what changes would you consider to impart scalability into your data model?