FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2023 FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT

Roll Number

COMPUTER SCIENCE, PAPER-I

TIME ALLOWED: THREE HOURS	**PART-I (MCQS)**	**MAXIMUM MARKS = 20**
PART-I(MCQS): MAXIMUM 30 MINUTES	**PART-II**	**MAXIMUM MARKS = 80**

NOTE: (i) Part-II is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FOUR** questions from **PART-II**, by selecting **TWO** questions from **EACH SECTION. ALL** questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the question will not be considered.

PART-II
SECTION-A

Q. No. 2. **(a)** Write a detailed note on any 03 Super Computing Technologies being used in the world. List key characteristics in each case. **(8)**

(b) What performance metrics are used to analyze the capacity of Super Computers? Discuss. **(6)**

(c) Discuss the role of Web Crawling, Indexing & Searching operations for a Search Engine. **(6)**

Q. No. 3. **(a)** How does dynamic memory allocation is managed programmatically in a C++ program? Clarify yours understanding through a viable program. **(8)**

(b) Write a note on the use of overloaded operators. Discuss with examples. **(6)**

(c) What is bit twiddling? Give brief description. **(6)**

Q. No. . **(a)** What is Polymorphism? Explain Ad-Hoc Polymorphism, Parametric Polymorphism & Subtyping with suitable coding examples. **(8)**

(b) Discuss Late Binding with a short program. **(6)**

(c) Differentiate between Abstraction & Encapsulation. **(6)**

SECTION-B

Q. No. 5. **(a)** For analyzing an Algorithm theoretically & asymptotically, give a detailed note on Input size, unit of time & order of growth. Support your answer with appropriate mathematical equations. **(8)**

(b) Briefly describe the four types of analysis we may perform to evaluate the asymptotic behavior of an algorithm. **(6)**

(c) Evaluate order of growth of the functions given below. Compare & write down which one has higher, same or lower order of growth than the other one: **(6)**

I. $n(n+1)$ and $2000n^2$ II. $100n^2$ and $0.01n^3$
III. $Log^2 n$ and $\ln n$ IV. 2^{n-1} and 2^n
V. $(n-1)!$ and $n!$

Q. No. 6. **(a)** Discuss the architecture of aspect-oriented system. **(8)**

(b) Briefly discuss the motivation for aspect-oriented programming. **(6)**

(c) Briefly describe 05 agile software development frameworks. **(6)**

COMPUTER SCIENCE, PAPER-I

Q. No. 7. **(a)** Design and draw a finite automaton to recognize the regular language of all strings that contain the string '001' as a substring. **(8)**

(b) Consider the following state diagram and extract the standard information, i.e., Q, Σ, q_0, F and δ. **(6)**
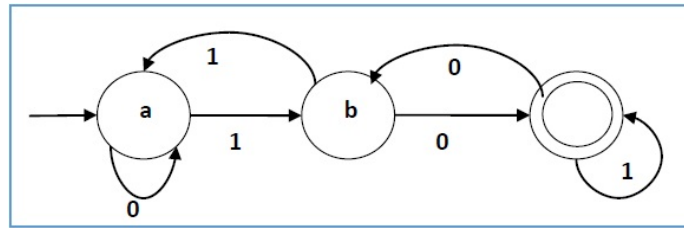
(c) How would you optimize a loop? Describe the techniques briefly. **(6)**

Q. No. 8. **(a)** Discuss the role of Syntax Tree in representing formal text structure. Develop a Syntax Tree structure for the following piece of code: **(8)**

```
while b ≠ 0
   if a > b
      a = a - b;
   else
      b = b - a;
return a;
```

(b) Describe your understanding on Constant Folding using a brief pseudo code. **(6)**

(c) What is an Optimization problem? What are its 02 general categories? Write down mathematical representation of a standard optimization problem. **(6)**

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COMPUTER SCIENCE, PAPER-II

TIME ALLOWED: THREE HOURS	PART-I (MCQS)	MAXIMUM MARKS = 20
PART-I(MCQS): MAXIMUM 30 MINUTES	PART-II	MAXIMUM MARKS = 80

NOTE: (i) Part-II is to be attempted on the separate **Answer Book.**
    (ii) Attempt **ONLY FOUR** questions from **PART-II** by selecting **TWO** questions from **EACH SECTION**. **ALL** questions carry **EQUAL** marks.
    (iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
    (iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
    (v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
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PART – II (SECTION – A)

Q. 2. **(a)** Suggest reasons why RAMs traditionally have been organized as only one bit per chip whereas ROMs are usually organized with multiple bits per chip. (7)

    (b) Consider a dynamic RAM that must be given a refresh cycle 64 times per ms. Each refresh operation requires 150 ns; a memory cycle requires 250 ns. What percentage of the memory's total operating time must be given to refreshes? (7)

    (c) In the context of RAID, what is the distinction between parallel access and independent access? (6) **(20)**

Q. 3. **(a)** The CPU in a router can process 2 million packets/sec. The load offered to it is 1.5 million packets/sec. If a route from source to destination contains 10 routers, how much time is spent being queued and serviced by the CPUs? (7)

    (b) An IP datagram using the strict source routing option has to be fragmented. Do you think the option is copied into each fragment, or is it sufficient to just put it in the first fragment? Explain your answer. (7)

    (c) Give two examples of computer applications for which connection-oriented service is appropriate and also give two examples for which connection-less service is best. (6) **(20)**

Q. 4. **(a)** A 32-bit computer has two selector channels and one multiplexor channel. Each selector channel supports two magnetic disk and two magnetic tape units. The multiplexor channel has two line printers, two card readers, and ten VDTs terminals connected to it. Assume the following transfer rates. (12)

          Disk drive 800 Kbytes/s
          Magnetic tape drive 200 Kbytes
          Line printer 6.6 Kbytes/s
          Card Reader 1.2 Kbytes/s
          VDT 1 Kbytes/s
    Estimate the maximum aggregate I/O transfer rate in this system.

    (b) Consider a program that access a single I/O device and compare un- buffered I/O to the use of a buffer. Show that the use of buffer can reduce the running time by at most a factor of two. (8) **(20)**

Q. 5. **(a)** An I/O -bound program is one that, if run alone, would spend more time waiting for I/O than using the processor. A processor-bound program is the opposite. Suppose a short term scheduling algorithm favors those programs that have used little processor time in the recent past. Explain why this algorithm favors I/O bound programs and yet does not permanently deny processor time to processor-bound programs? (10)

    (b) Suppose that instead of using 16-bits for the network part of a class B address originally, 20 bits had been used. How many class B networks would there have been? (5)

    (c) What is the distinction between instruction-level parallelism and machine parallelism? (5) **(20)**

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(SECTION – B)

Q. 6. **(a)** Explain the following different SELECT statement search conditions with examples using any database schema of your choice: (12)
1. Compound Comparison Search Condition
2. Range search condition (BETWEEN/NOT BETWEEN)
3. Set membership search condition (IN/NOT IN)
4. Pattern match search condition (LIKE/NOT LIKE)

(b) Explain ACID property of a transaction (4)

(c) Explain Transitive dependency using any example. (4) **(20)**

Q. 7. **(a)** A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following: (10)

- How many minutes would it take to transmit a 1024×1024 image with 256 intensity levels using a 56k baud modem?
- What would the time be at 750K baud, are representative speed of a phone DSL (Digital subscriber line) connection?

(b) What effect would setting to zero the lower-order bit planes have on the histogram of an image in general? (5)

(c) What would be the effect on the histogram if we set to zero the higher order bit planes instead? (5) **(20)**

Q. 8. **(a)** How SEO improves your website traffic? Explain with proper reasons and coding examples. (8)

(b) Suppose your web team is going to make a contract with the customer and you need to estimate the cost of application development. What pricing factors you consider to estimate the cost? (8)

(c) Write the jQuery code to slide elements up and down. Use HTML, CSS, and jQuery (4) **(20)**

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