FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT, 2015

Roll Number

COMPUTER SCIENCE

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

NOTE:
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- **(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.
- **(vi)** Extra attempt of any question or any part of the attempted question will not be considered.
- **(vii)** **Use of Calculator is allowed.**

PART-II

SECTION-A

Q.No.2. (a) Why Registers are used in CPU operations? Define the purposes of MAR, IR and Program Counter. **(08)**

(b) Give scheme for Deadlock Prevention. **(06)**

(c) Elaborate the concept of IPV6. Explain its advantages over IPV4. **(06)**

Q.No.3. (a) Explain the functionality of seven layers of OSI reference model and map with TCP/IP protocol suite. **(08)**

(b) Discuss Instruction Execution Cycle. **(06)**

(c) Briefly explain Paging and Segmentation with diagrams. **(06)**

SECTION-B

Q.No.4. (a) Explain the functionality of Hash Table. By supposing that table size is 100, give steps to insert data 112, 2023, 3001 into Hash Table and then to search 2023 from Hash Table. **(08)**

(b) What is the difference between Function Overloading and Function Overriding? Explain your answer by giving example syntax for each one. **(06)**

(c) Write short notes on the following: **(06)**
   I.   USECASE Diagram   II.   Activity Diagram

Q.No.5. (a) Write down difference between: **(08)**
   I.   Data Hiding and Encapsulation   II.   Constructor and Copy Constructor

(b) Build and draw a Binary Search Tree for the following input data 25, 11, 75, 69, 115, 50, 72, 17, 200, 60, 35. **(06)**

(c) Explain Incremental Model of Software Engineering by giving its advantages over other models. **(06)**

SECTION-C

Q.No.6. (a) Write down notes on the following: **(08)**
   I.   CRT Display Devices   II.   LCD Display Devices

(b) What is CSS? How many ways are there to link CSS and XHTML? **(06)**

(c) Write note on the followings: **(06)**
   I.   3NF   II.   BCNF

Q.No.7. (a) Differentiate between the following by giving their respective definitions and concepts **(08)**
   I.   Equvi Join   II.   Outer Join   III.   Natural Join

(b) What are different web Architectures? Explain their Advantages and Disadvantages. **(06)**

(c) Write down Incremental Algorithm for Line drawing from $p_0(x_0,y_0) \rightarrow p_1(x_1,y_1)$ where $x_1 > x_0$ and $|dx| > |dy|$ **(06)**

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION - 2016
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT
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.**
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PART-II
SECTION-I

Q. 2.   **(a)**   Write a program to input choice from user for temperature conversion from Fahrenheit   **(6)**
to Celsius or Celsius to Fahre00000000nheit. After the choice, input temperature from user and display the converted answer. Sample execution of the program is given below;
1.   Fahrenheit to Celsius
2.   Celsius to Fahrenheit
Enter your choice: 1
Enter Temperature in Fahrenheit: 98
Same Temperature in Celsius: 36.7
Press Any Key to Continue....

(b)   Which type of computer (supercomputers, mainframe computers, minicomputers,   **(6)**
microcomputers) will suit an individual? Justify your answer.

(c)   Suppose you are trying to build a Student Registration System using object oriented   **(8)**
approach. Objective of the system is to store information of course registration of students and their course results. In C++ syntax define following classes with suitable attributes each having getdata( ) and showdata( ) member functions along with suitable constructor functions;
Person, Teacher, Student, Course, Section, Allocation (containing information about allocation of a course to a teacher in a semester), Registration (containing information about registration of a student in course, this class will also save course result information of the student). You can add more classes which you think suitable for the system.

Q. 3.   **(a)**   Define a function named monthly-profit which will calculate the monthly profit on the   **(6)**
given investment amount. Function will take two float arguments, percent profit rate and investment amount and return the monthly profit (float). Write function prototype, function definition and a main program to demonstrate the functionality. Sample execution of the program is given below. Note that monthly profit 4000 has been calculated by the function by doing (8/100) * 50000. User can enter any values therefore write generalized function (user variables, not given values).
Enter percent profit rate: 8
Enter investment amount: 50000
Monthly profit: 4000
Press Any Key to Continue....

(b)   Explain and differentiate between volatile and non-volatile memory, giving examples.   **(6)**

(c)   Suppose you are trying to build a Library Information System using object oriented   **(8)**
approach. System should be able to keep track of books issued and returned. It should be able to calculate fine if a book is late. Currently you are required to design classes i.e. not to write C++ code but describe which class you will define, which data members you will add, which member functions you will include in those classes. Define only suitable classes and suitable attributes (data members) in C++ syntax. Names of some classes are like, Student, Teacher, Book, Issue Book etc. You can (but not required to) extend this list of four classes if you think of some other suitable classes.

Q. 4. **(a)** Define a structure to store records of Persons. We want to store only Name, age and address of Person. Write main program to input record of one person and display 'Young' if its age is less than 20 or 'Old' if the age is greater than 50 and 'Middle' if the age of person is between 21 and 49. Sample execution of the main program is given below: **(6)**

Enter Name = <u>Kashif</u>

Enter Age = <u>19</u>

Enter Address = <u>H 120, St: 08, KAR</u>.

Person is YOUNG

Press Any Key to Continue ......

(b) Convert given binary numbers to Decimal, Octal and Hexadecimal. **(6)**
(i) $100_{(2)}$ (ii) $10100_{(2)}$ (iii) $100101_{(2)}$

(c) Suppose you are designing software for a Medical Store, using object oriented techniques. Decide and define classes (like 'Person', 'Customer', 'Salesman', 'Purchase' etc.) and their attributes in C++ or Java syntax. You are not required to write any member functions and main programme. You must use inheritance where suitable. **(8)**

SECTION-II

Q. 5. **(a)** Describe the followings (no description with more than three lines); **(8)**
i.   Sibling Nodes   ii.   Degree of a tree   iii.   Leaf Node
iv. Height/ Depth of a tree   v.   Binary Tree   vi.   Full Binary Tree
vii. Complete Binary Tree   viii. Maximum number of nodes in a Binary Tree at level L.

(b) Find the time complexity of Binary search by resolving the recurrence (given below) using iterative substitution method. **(6)**

$T(1) \quad = 2 \qquad\qquad$ if n =< 1

$T(n) \quad = 4 + T(n/2) \qquad$ if n>1

(c) Draw the given array in the form of binary tree. Then apply 'Build-Heap' Algorithm to convert the given tree in the form of Max-Heap (i.e. draw final Max-heap in the form of tree and array). Finally show execution of 'Heap-sort' algorithm by rewriting the Heap array after each iteration of the algorithm. **(6)**

A = {8, 14, 2, 26, 10, 12, 16, 28, 20, 7}

Q. 6. **(a)** Write Abstract Data Types (ADT) of Stack and Queue. Include the specifications of Add, Delete, IsEmpty, IsFull functions along with their respective functions. **(8)**

(b) For step count expressions $n^2 + 10$ and $2^n / 4$ find breakeven point i.e. for which value of n (starting from 1,2…) second expression will become greater than value of first expression. **(6)**

(c) In AVL tree balance factor of every node is -1 or 0 or +1. We can calculate the balance factor as Height $_{left-sub-tree}$ – Height $_{right-sub-tree}$. Construct AVL tree from the given data; **(6)**

A = {8, 14, 2, 26, 10, 12, 16, 28, 20, 7}

Q. 7. **(a)** Draw a diagram that illustrates the process of translating a C++ source file into an executable file. Give example of each phase depicted in your diagram of compilation process. **(5)**

(b) Compare and contrast among compiler, interpreter and assembler. **(5)**

(c) Describe Software Development Life Cycle (SDLC). Explain your answer with the help of depicting and describing different phases of pure water fall software life cycle. **(5)**

(d) What is the difference between SRS document and design document? What are the contents we should contain in the SRS document and design document. **(5)**

Q. 8. **(a)** What are the purposes of Data Flow diagrams, Entity-Relationship diagrams? Give an example diagram of each. **(5)**

(b) Explain five properties of language using the example of English. Explain why a software language like MiniJava meets these properties as well. **(5)**

(c) Lexical analysis: Consider the following regular expression **(5)**
$$r_1 = (A \mid \dots \mid Z) * \ (0 \mid \dots \mid 9)*$$
Describe the language defined by r_1 in English. Turn r_1 into an equivalent finite automaton. Remove ε-moves from the finite automation.

(d) What do you mean by Context Free Grammar (CFG)? Illustrate your answer with examples. **(5)**

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UNDER THE FEDERAL GOVERNMENT

Roll Number

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.**
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PART-II
SECTION-A

Q. 2. **(a)** Suppose you add two new devices to an existing five-device network. If you have a fully connected mesh topology, how many new cable lines are needed? If, however, the devices are arranged in a ring, how many new cable lines are needed? **(6)**

   (b) Transmission media are not perfect because of imperfections and impairments in the signal sent through the medium. Signals at the beginning and at the end of the medium are not the same. Discuss in detail the impairments in the transmission medium. **(7)**

   (c) Whenever multiple devices are used in a network, the problem arises that how to connect them to make one-on-one communication possible. Switching is the best solution for this kind of problem. A switched network consists of a series of inter-linked nodes called switches. Explain briefly the methods of switching used by computer networks. **(7)**

Q. 3. **(a)** RAID is a physical disk drives viewed by the operating system as a single logical drive, where data are distributed across the physical drives of an array. Explain different levels of RAID? Elaborate your answer with suitable diagrams. **(8)**

   (b) The basic function performed by a computer is execution of a program, which consists of set of instructions stored in memory. The processor required for a single instruction is called an instruction cycle. Elaborate basic instruction cycle used by modern computer systems. Also add diagrams for explanation. **(6)**

   (c) Differentiate between Reduced Instruction Set Computers (RISC) and Complex Instruction Set Computers (CISC) architectures. **(6)**

Q. 4. **(a)** Deadlock prevention algorithms prevents deadlock by restraining how requests can be made, the restrain ensure that at least one of the necessary conditions for deadlock cannot occur and hence, that deadlock cannot hold. Explain the Banker's Algorithm for deadlock avoidance. **(8)**

   (b) Central Processing Unit (CPU) scheduling deal with the problem of deciding which of the processes in the ready queue is to be allocated to the CPU. What are the pros and cons of *Multilevel Queue Scheduling* and *Multilevel Feedback Queue Scheduling*? **(6)**

   (c) What do you know about Process Control Block? Discuss its components in detail. **(6)**

SECTION-B

Q. 5. **(a)** A complete SELECT statement embedded within another SELECT statement. The results of this inner SELECT statement (or subselect) are used in the outer statement to help determine the contents of the final result. Differentiate among following nested sub-queries operators "IN", "ANY" and "ALL". **(8)**

   (b) Explain how Pattern match search condition (LIKE/NOT LIKE) can be used in SELECT statement part of SQL in database management system. **(6)**

   (c) Differentiate between Data Manipulation Language (DML) and Data Definition Language (DDL) of structured query language (SQL) in database management system (DBMS). **(6)**

COMPUTER SCIENCE, PAPER-II

Q. 6. **(a)** A transaction is a unit of program execution that accesses and possibly updates various data items. Usually, a transaction is initiated by a user program written in a data manipulation language. Explain the ACID property of transaction processing. **(8)**

(b) Distinguish among functional dependency, Fully functional dependency and Transitive dependency. **(6)**

(c) A trigger is a statement that the system executes automatically as a side effect of a modification to the database. What are the different forms of triggers and how they are defined? **(6)**

Q. 7. **(a)** Write down a short note on Array versus Matrix Operations **(6)**

(b) Differentiate between CMY and CMYK Colour Models used in digital image processing. **(6)**

(c) Explain the Boundary Extraction Algorithm used for basic morphology. **(8)**

Q. 8. **(a)** Explain the principals of requirement engineering of web applications. **(8)**

(b) Elaborate the term E-Commerce. Discuss in detail about the effects of E-Commerce in Islamic Banking in Pakistan. **(6)**

(c) What are the components of Generic web application architecture? **(6)**

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COMPUTER SCIENCE, PAPER-I

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PART-II
SECTION-I

Q. 2. **(a)** The internet era has given rise to the problem of cybercrimes. Given the need to maintain privacy which is an ethical responsibility of the government, what technical means would you suggest to curb this problem? **(8)**

(b) Describe the difference between Harvard and Von-Neumann architectures of computers. Also discuss their traits in the light of their capabilities. **(6)**

(c) Virtual memory is used by the computer to support the running of heavy applications. Describe the functioning of virtual memory in the computer. Also comment on the management of virtual and physical memory by an operating system. **(6)**

Q. 3. **(a)** Three types of languages exist for use in programming of computers, Machine, Low Level and High Level languages. Elucidate on these three types, giving details of the conversion process between Low Level and High Level language into Machine language. **(8)**

(b) Write a function that calculates the quadratic equation in $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. You may use the math library for this purpose. The program should ask the user to enter values of a, b and c and should print the result. A sample execution of the program is shown below:
Enter value of a: 1
Enter value of b: 2
Enter value of c: 1
The values of x are -1, -1 **(6)**

(c) Consider that you are required to create a program for a supermarket checkout machine. The machine has a database of the items available in the supermarket which consists of the items name, code and price. Make a program that requires the cashier (user) to enter the code or name of the product and the quantity that has been bought. It should allow for multiple entries to be made. Once all the entries have been made. The program prints the total amount to be charged on the screen. A sample execution is shown below:
Enter product name or code: 1
Enter quantity: 1
Do you have more products to add (Y/N): N
The total amount is 500
You may construct the database as a structure. **(6)**

Q.4. **(a)** What factors should be considered when choosing particularly between evolutionary and incremental models? Elucidate the characteristics of Rapid Application Development, Joint Application Development and Agile Software Engineering. **(8)**

(b) Differentiate between Software Validation and Verification. Discuss some of the techniques used for empirical software evaluation. **(6)**

(c) Discuss the importance of Requirements Engineering in the success of a software project. Explain in detail the process of 'Requirements Sign-off'. **(6)**

Q. 5. **(a)** Draw and build a Red-black tree for the following keys (50, 60, 70, 80, 90) and (50, 40, 30, 20, 10). Would a binary tree be suitable for the insertion of these keys? **(8)**

(b) Hash tables enable for fast insertion and searching within the database. Describe the process of hashing with a suitable example. **(6)**

(c) Describe the process of Bubble Sorting. Write down the output after each pass of the Bubble Sort algorithm for sorting the sequence (3, 8, 2, 6, 1, 10). **(6)**

SECTION-II

Q. 6. **(a)** The design methodologies of programs can have multiple approaches including the Big Bang, Code and Fix, Water Fall and the Spiral Model. Consider a test application and describe the development of the application while following each of these four approaches. **(8)**

(b) Discuss the design issues of Task Partitioning and Task Allocation in Distributed Software Engineering tasks. **(6)**

(c) Explain the importance of Design Patterns under the umbrella of Agile software design and programming. Explain Software Testing and different methodologies. **(6)**

Q. 7. **(a)** The handling of syntax errors involves the use of parser and the lexical analyzer. Comment on its functioning. **(8)**

(b) Using a suitable example, compare the operation of a top-down and a bottom-up Parser based compiler. **(6)**

(c) Explain the two different methods of code optimization that is Loop optimization and Peephole optimization by giving a suitable example. **(6)**

Q. 8. Write short notes on any FOUR of the following: **(5 each)** **(20)**

(a) Global, Local and shared variables for nested function access

(b) Protecting IP rights in the digital domain

(c) Parallel processing and the use of pipelining for this purpose

(d) Resource allocation during runtime processes

(e) Intermediate Code Generation

(f) Searching Algorithms

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TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT
COMPUTER SCIENCE, PAPER-II

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PART-II
SECTION-A

Q. 2. **(a)** Discuss the following methods of storage systems: **(8)**
  (i) Direct Access **(ii)** Random Access

  (b) If clock speed reaches its maximum then what are the two methods to increase the performance of a computer? Briefly explain. **(6)**

  (c) Draw and explain instruction execution state diagram with interrupt. **(6)**

Q. 3. **(a)** Explain the following network protocols: **(8)**

  (i) HTTP and SIP **(ii)** TCP and UDP

  (b) What is the transmission time of a packet sent by a station if the length of the packet is 1 million bytes and the bandwidth of the channel is 200 Kbps? **(6)**

  (c) Given the IP address 10.5.118.3 and the network mask 255.255.240.0, what are the assignable IP addresses and broadcast in this subnet? **(6)**

Q. 4. **(a)** What are differences between Optimal & LRU (Least Recently Used) page Replacement Policies? **(8)**

  (b) Discuss the four necessary conditions for deadlock to occur. How can we deny any two of these conditions? **(6)**

  (c) Consider three processes given in the table. Find average waiting time and average turnaround (completion) time when these processes are scheduled using Round-Robin scheduling using time quantum (TQ) = 4. **(6)**

Process	CPU Burst
P1	24
P2	7
P3	10

Q. 5. **(a)** Explain the functionality and purposes of following registers with diagrams: **(8)**
  (i) Memory Address Register (MAR)
  (ii) Memory Buffer Register (MBR)
  (iii) Instruction Register (IR)

  (b) Discuss the functionality of Ethernet LAN and its types. **(6)**

  (c) What happens in the following cases? **(6)**
  (i) If the job size is kept very low in time sharing systems.
  (ii) If the page size is kept very small in paged memory management.

SECTION-B

Q. 6. **(a)** What is Normalization? Discuss 1NF, 2NF and 3NF with example(s). **(8)**

(b) Write short notes on the following: **(6)**
    (i) Data   **(ii)** Database   **(iii)** Database Management System

(c) Differentiate between Centralized Database and Distributed Database. **(6)**

Q. 7. **(a)** Define image histogram. What is meant by histogram equalization? Explain their applications in image processing. **(8)**

(b) Find the storage in bytes required to store a 256 x 200 colored image using RGB color model with 24 bit color depth. **(6)**

(c) Briefly explain Geometric Transformations. **(6)**

Q. 8. **(a)** Explain the following web concepts: **(8)**

    (i) localStorage and sessionStorage objects

    (ii) Application cache in HTML5

    (iii) Manifest file

    (iv) Web Worker

(b) What is SVG? What are the advantages of SVG over JPEG or GIF? **(6)**

(c) Explain Non Breaking space in HTML with example. **(6)**

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION - 2018
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT
COMPUTER SCIENCE, PAPER-I

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PART-II
SECTION-I

Q. 2. **(a)** How many layers are in the TCP/IP stack? What are the names? **(4)**

    (b) How digital evidences can be preserved from a crime scene. Write in details by taking examples of digital devices commonly used these days. **(4)**

    (c) What are the responsibilities of Operating system kernel? **(3)**

    (d) List down any four best practices for coding standards. **(3)**

    (e) Why do modern processors use more power when their clock frequency is increased? **(2)**

    (f) Ali is telling Ahmad that he is representing a -ve number and its most significant bit is 1, Ahmad immediately shouted you are representing numbers using 2's compliment. True or False. And why? **(2)**

    (g) If time slice is of 50 milliseconds and context switch requires a microsecond, how many processes can the machine service in a second? **(2)**

Q. 3. **(a)** Write a program grade average calculator, User will input marks for five subjects and program will output the average of its marks. Print appropriate message on the base of its mark's average e.g.; Well done, Keep it up, Better luck next time etc. **(5)**

    (b) Given that i,j,k,n & m are integer variables. Write a condition such that: **(2)**
      i-   hello is only printed when, any of the following conditions are met: i is twice the value of j, j is smaller than k and less than n, or m is negative.
```
inti,j,k,n,m; cin>>i>>j>>k>>n>>m;
 if(            )
 cout<<"hello";
```

      ii.   hello is only printed when i does not lies in the interval 6-9
```
inti; cin>>i;
    if(        )
    cout<<"hello";
```

    (c) Write equivalent instruction to following instruction without the use of += operator: where w,z are integers. **(1)**
```
        w+=2*z+4;
```

    (d) Predict the values of variables a & b after every instruction **(2)**
```
integer a=5 b=6
a=(b++) + 3;
b=--a;
```

    (e) Complete the code such that it prompts the user for +ve number n. Then displays the output.(whatever the value of n is)(HINT: instead of triangles of stars its triangles of increasing numbers)[marks **(5)**
```
1 2 3 4 . . . n
1 2 3 4 ..n-1
. . .
. . .
1 2
1
```

```
for n=4 it will print
1 2 3 4
1 2 3
1 2
1
void main()
{
int n; cin>>n;
// your loops will go here

}
```

(f) In following code replace the character at posth location in the string st with the ,character **(5)**
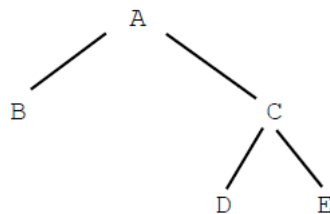ch. For example in string helloworld replacing 2nd character with i would result in
hilloworld

```
void main( )
{char st[15]; int pos; char ch;
int size=0;
cin>>st;
cin>>pos>>ch;
while(st[size]!='\0')
{
size++; // calculating length of current string
}
// write your code here

}
```

Q. 4. Consider the inheritance hierarchy shown below. Each part of this question is independent.

(a) In which class(es) would it make most sense to have protected members? Which class(es) **(5)**
would be able to access those protected members directly?

(b) Which class(es) can access private members of class C directly? **(5)**

(c) Suppose class C contains a pure virtual function. Suppose we wish to instantiate objects of **(5)**
this hierarchy. Which class(es) are or could be abstract and which are concrete?

(d) Consider the following list of classes: Car, SteeringWheel, Vehicle, Van, Minivan, **(5)**
AudioSystem, ParkingLot. Your task is to describe all of the *is-a* and *has-a* relationships
between these classes. Include an inheritance hierarchy for all classes that fit. Fill in the
table with *is-a* or *has-a* relationship while leaving the cells empty where no relation is
applicable.

	Vehicle	Car	Van	Mini Van	Steering Wheel	Audio System	Parking Lot
Vehicle							
Car	*is-a*						
Van							
Mini Van							
Steering Wheel							
Audio System							
Parking Lot							

SECTION-II

Q. 5. **(a)** What is dangling pointer? **(3)**

(b) What data structure would employ to build a text editor and why? **(5)**

(c) Random insertion of nodes into a binary search tree would result in what types of tree shape. Elaborate. **(7)**

(d) How would you modify a link list based queue so that first and last node can be accessed in a constant time regardless of data nodes in the queue? **(5)**

Q. 6. **(a)** Define balanced tree both for AVL and Binary search tree. **(4)**

(b) What is informed or heuristic search what type of algorithm is used to do such a search? **(6)**

(c) Differentiate between graph and trees. Which is special case of the other? **(5)**

(d) Explain what type of problems can be solved by genetic algorithm. **(5)**

Q. 7. **(a)** Outline the difference between software verification and software validation. **(4)**

(b) Give an outline of the unit testing process for verification. **(4)**

(c) Agile Development is a process that values responding to change over following a plan. Discuss three issues a Software Engineer should be mindful of when adopting this approach during software development. **(4)**

(d) What type of project is not suited to incremental methods? **(4)**

(e) Outline the difference between Black box and White box testing. **(4)**

Q. 8. **(a)** What is the difference between lexers and parsers? **(5)**

(b) Write a grammar (BNF) for the language of palindromes. **(5)**

(c) Here DFA is given for the language L find the DFA for L^2 **(5)**
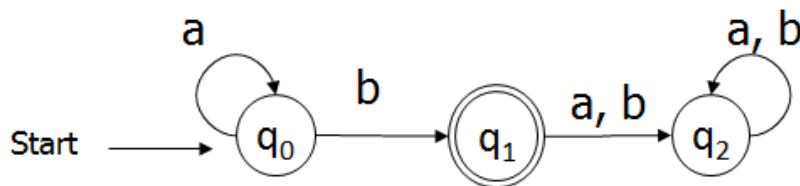
(d) Convert the following DFA to a RE: **(5)**

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2018
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

COMPUTER SCIENCE, PAPER-II

TIME ALLOWED: THREE HOURS PART-I(MCQS): MAXIMUM 30 MINUTES	PART-I (MCQS) MAXIMUM MARKS = 20 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.
(vi) Extra attempt of any question or any part of the attempted question will not be considered.

PART – II
SECTION – A

Q. No.2. (A) Briefly describe the functionality of the following CPU special-purpose registers: Instruction Register (IR), Memory Data Register (MDR) and Program Counter (PC). **(8)**

(B) Differentiate between Address, Data and Control bus. **(6)**

(C) Discuss instruction pipelining in the context of fetch-decode-execute cycle. **(6)**

Q. No.3. (A) Differentiate between hub, bridge, switch and router. **(8)**

(B) Discuss how Network Address Translation (NAT) works and why is it useful? **(6)**

(C) Elaborate the working of multiplexing/de-multiplexing at the transport layer. **(6)**

Q. No.4. (A) There are three processes P_A, P_B and P_C and three resources R_A, R_B and R_C. Resources R_A and R_B have one instance each while resource R_C has two instances. P_A is holding one instance of R_C and has requested for R_A. Process P_B is holding R_A and has requested for R_B. R_B is allocated to P_C which has also requested an instance of R_C. Represent the scenario with a resource allocation graph. Discuss whether there is a deadlock or not? If yes, which processes are blocked? **(8)**

(B) In the context of Paging, consider the case where memory addresses are 32 bits i.e. 20 bits Virtual Page Numbers and 12 bits of offset. How many virtual pages are there and what is the size of each page? Given the virtual address 0x7589, find the virtual page number and offset. If the respective page table entry contains 0x900DF, find the physical address. **(6)**

(C) In the context of I/O management, differentiate between Pooling and Interrupts. **(6)**

Section – B

Q. No.5. (A) Given two relations **R** and **S**, where **R** contains **M** tuples, **S** contains **N** tuples, and **M >N > 0**, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. **(8)**
  i. $R - S$
  ii. $R \cup S$
  iii. $R \cap S$
  iv. $R \bowtie S$

(B) Elaborate the concepts of super key, candidate key and foreign key with examples. **(6)**

(C) Discuss the difference between physical data independence and logical data independence. **(6)**

COMPUTER SCIENCE, PAPER-II

Q. No.6. (A) Differentiate between image sampling and quantization. Discuss how these concepts relate to spatial and intensity resolutions. **(8)**

(B) In the context of image smoothing, discuss the differences between mean and median filters. **(6)**

(C) For the image 'X' shown in Figure 1, show the result of applying the given morphological operators. Assume zero padding for border pixels. **(6)**
  i.   Dilation of X by structuring element [1 1 1].
  ii. Erosion of X by structuring element [1 1 1]^T
  iii. Dilation of X by a 3x3 structuring element containing all ones.

0	0	0	0	0	0	0	0
0	1	1	0	0	1	1	0
0	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	1	1	1	1	0	0
0	0	0	0	0	0	0	0

Q. No.7. (A) Perform histogram equalization on the 8-bit image shown in Figure 2. **(8)**

5	5	5	5	5
10	10	10	10	10
30	30	30	30	30
100	100	100	100	100
100	100	100	100	100

(B) For the 3x3 image shown in the following, apply the horizontal and vertical Sobel operators and compute the magnitude of gradient at the central pixel with intensity value 50. **(6)**

5	5	5
5	50	5
5	5	5

(C) In the context of compression, differentiate between coding, spatial and temporal redundancies. **(6)**

Q. No.8. (A) Elaborate the concept of three tier architecture with reference to presentation, business logic and data access layers. **(8)**

(B) Differentiate between XHTML and XML. **(6)**

(C) Discuss Agile and Water Fall methodologies in the context of web application development. **(6)**

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2019
FOR RECRUITMENT TO POSTS IN BS-17
## UNDER THE FEDERAL GOVERNMENT

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 – I

Q. 2. **(a)** Give a detailed note on a revised BSD 3-clause license. Also name 5 softwares using this license. (10)

(b) How do artificial intelligence may facilitate us in improving cyber security? (5)

(c) What are the main parts and phases of a computer virus program? (5) **(20)**

Q. 3. **(a)** See the following C++ program to declare whether an input number is a prime number or not. Identify the logical errors in the given program (if any). Give your correct statement(s) exactly at the same line number. (10)

```
1.      n, i;
2.      bool is Prime = false;
3.      cout<< "Enter a positive integer: ";
4.      cin>> n;
5.      for(i = 1; i< n / 2; ++i)
6.      {
7.      if(n /i == 0)
8.      {
9.      is Prime = false;
10.     break;
11.     }
12.     }
13.     if (is Prime)
14.     cout<< "This is a prime number";
15.     else
16.     cout<< "This is not a prime number";
```

(b) What is the difference between call by value and call by reference? (5)

(c) What is the role of preprocessor directives? Give three examples in C++. (5) **(20)**

Q. 4. **(a)** How do the OOP paradigm can be associated with the real-world problems? Explain. (10)

(b) Discuss critical reasons given by the professionals for not supporting the OOP paradigm. (10) **(20)**

Q. 5. **(a)** Discuss the security issues associated with the cloud computing. (10)

(b) What is bit twiddling? Give brief description. (5)

(c) An image is a representation of some information. Discuss how does a computer represents an image internally? Name different algorithms used to extract features from images. (5) **(20)**

SECTION-B

Q. 6. **(a)** Discuss the limitations of genetic algorithms. (10)

(b) What is AVL tree? Under what condition, a binary tree becomes AVL tree? (5)

(c) Consider the following graph. Find out the sequence of edges added to the (5) **(20)** minimum spanning tree using Kruskal's algorithm.
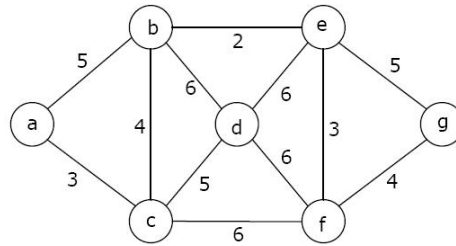
Q. 7. **(a)** Discuss the architecture of aspect-oriented system. (10)

(b) Briefly discuss the motivation for aspect-oriented programming. (5)

(c) What is the significance of quantification and obliviousness? (5) **(20)**

Q. 8. **(a)** Write down the major steps involved in code generation. (10)

(b) How would you optimize a loop? Describe the techniques briefly. (5)

(c) Differentiate machine-dependent optimization and machine-independent (5) **(20)** optimization.

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2019
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

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.
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(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.
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PART – II
SECTION-A

Q. No. 2. **(a)** Compare the main features of CISC and RISC architectures. Which type of architecture is suitable for pipelining? (8)
(b) Demonstrate use of superscalar approach to achieve instruction level parallelism using a suitable example. (6)
(c) List all basic functions of buses in the context of computer architecture. (6) **(20)**

Q. No. 3. **(a)** Show field by field comparison for IPv4 and IPv6 packets. (8)
(b) Explain the following routing techniques using suitable examples. (6)
(i) Link State Routing
(ii) Distance Vector Routing
(c) Show step by step procedure of error detection using cyclic redundancy check method for a 7 bit code block "1001001". Assume appropriate generator polynomial. (6) **(20)**

Q. No. 4. **(a)** Demonstrate step by step procedure for process swapping between main memory and secondary memory. (8)
(b) Show flow chart of a process scheduling mechanism using various queues. (6)
(c) Explain the difference between Sequential Access and Indexed Sequential Access in the context of file access using a suitable example (6) **(20)**

Q. No. 5. **(a)** Demonstrate various types of multiplexing techniques in the context of computer networks using suitable examples. (8)
(b) Show step by step procedure to find MAC address of a node in a network using Address Resolution Protocol. (6)
(c) For transmission of voice signal in real time over the network, select a suitable switching technique. Justify your answer using an example. (6) **(20)**

SECTION-B

Q. No. 6. **(a)** Analyze the following noise models in the context of digital image processing. (8)
(i) Gaussian Noise Model
(ii) Uniform Noise Model
(b) Compare RGB and HSI color models in the context of digital image processing. (6)
(c) Describe step by step process of application of compression based technique for image segmentation. (6) **(20)**

Q. No. 7. **(a)** A Medium advertising company is reviewing its IT requirements and is (8) considering using a Cloud solution for web applications as opposed to investing in existing infrastructure. Is this an appropriate strategy? Justify your answer using an example.

(b) Describe briefly the role of validation in requirement engineering (6) process.

(c) Explain the difference between functional and non-functional requirement (6) **(20)** in the context of web engineering using a suitable example.

Q. No. 8. **(a)** Demonstrate the use of ER Model in database designing process using an (8) example.

(b) Describe an appropriate security scheme for a database maintained by a (6) bank. Justify your answer using an example.

(c) Explain the difference between top-down and bottom-up approaches in (6) **(20)** the context of distributed database design using a suitable example.

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

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(vi) Extra attempt of any question or any part of the attempted question will not be considered.

PART – II
SECTION – A

Q. No.2.
(a) Explain Moore's law. List high computing requirements in contemporary computing. **(7)**
(b) List and briefly define two approaches to dealing with multiple interrupts. **(6)**
(c) What is instruction-level parallelism? What are some typical distinguishing characteristics of RISC organization? **(7)**

Q. No.3.
(a) What is the kernel of an operating system? Explain the difference between a monolithic and microkernel. **(7)**
(b) What is the difference between simple and virtual memory paging? Also explain the purpose of translation lookaside buffer. **(6)**
(c) Why do we have deadlock in the multiprocessing environment? Explain different techniques for dealing with deadlocks. **(7)**

Q. No.4.
(a) Compare IPv4 and IPv6 headers. Explain the use of NAT technology to overcome IPv4 scarcity. **(8)**
(b) Find the maximum number of valid subnets and usable hosts per subnet that you can get from the network 172.23.0.0/23. **(6)**
(c) List and briefly define any THREE file organization techniques. Also explain basic Linux file system security. **(6)**

Q. No.5.
(a) What is signal encoding? Explain different encoding techniques used in data communication. **(8)**
(b) Explain the functions and needs of ARP and RARP protocols in computer networks. **(5)**
(c) Explain multiplexing and demultiplexing at the transport layer. Explain in the context of TCP/IP protocol. **(7)**

SECTION – B

Q. No.6.
(a) What is the purpose of a join in SQL? Explain inner, left, right and full join with the help of examples. **(8)**
(b) Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted. **(7)**
(c) Explain Two-phase locking (2PL) as a concurrency control mechanism in the database systems. **(5)**

Q.7.
(a) What is Histogram equalization? Explain the process and discuss its uses. **(6)**
(b) Explain types of color models. Also discuss the most common hardware oriented color models in detail. **(8)**
(c) What is translation and scaling? Find the number of bits required to store a 256x256 image with 32 gray levels. **(6)**

(a) "Web engineering is more challenging than traditional software engineering". Argue for or against. **(7)**
(b) Briefly discuss the role of validation and verification in requirement engineering. **(6)**
(c) Explain functional and non-functional requirements in the context of a web application development. **(7)**

FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2020
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

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.**
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PART – II
SECTION – A

Q. No.2. (a) Explain Moore's law. List high computing requirements in contemporary computing. **(7)**
(b) List and briefly define two approaches to dealing with multiple interrupts. **(6)**
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(b) What is the difference between simple and virtual memory paging? Also explain the purpose of translation lookaside buffer. **(6)**
(c) Why do we have deadlock in the multiprocessing environment? Explain different techniques for dealing with deadlocks. **(7)**

Q. No.4. (a) Compare IPv4 and IPv6 headers. Explain the use of NAT technology to overcome IPv4 scarcity. **(8)**
(b) Find the maximum number of valid subnets and usable hosts per subnet that you can get from the network 172.23.0.0/23. **(6)**
(c) List and briefly define any THREE file organization techniques. Also explain basic Linux file system security. **(6)**

Q. No.5. (a) What is signal encoding? Explain different encoding techniques used in data communication. **(8)**
(b) Explain the functions and needs of ARP and RARP protocols in computer networks. **(5)**
(c) Explain multiplexing and demultiplexing at the transport layer. Explain in the context of TCP/IP protocol. **(7)**

SECTION – B

Q. No.6. (a) What is the purpose of a join in SQL? Explain inner, left, right and full join with the help of examples. **(8)**
(b) Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted. **(7)**
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Q. No.7. (a) What is Histogram equalization? Explain the process and discuss its uses. **(6)**
(b) Explain types of color models. Also discuss the most common hardware oriented color models in detail. **(8)**
(c) What is translation and scaling? Find the number of bits required to store a 256x256 image with 32 gray levels. **(6)**

Q. No.8. (a) "Web engineering is more challenging than traditional software engineering". Argue for or against. **(7)**
(b) Briefly discuss the role of validation and verification in requirement engineering. **(6)**
(c) Explain functional and non-functional requirements in the context of a web application development. **(7)**

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FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2021 FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT
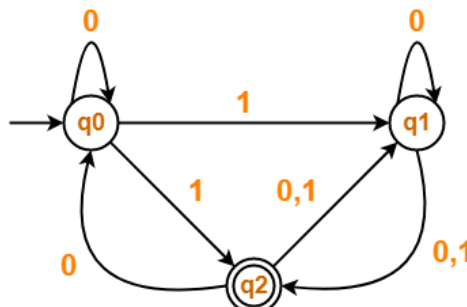## COMPUTER SCIENCE, PAPER-I

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.
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PART-II
SECTION-A

Q. No. 2.
- **(a)** What are office productivity tools? Explain uses of any two productivity tools in your home or workplace. **(7)**
- **(b)** Write a detailed note on computer crimes and ethical challenges. **(7)**
- **(c)** What are the different types of computers? Explain the benefits of miniaturization. **(6)**

Q. No. 3.
- **(a)** Describe any two of the following briefly: ISP, HTML, SSD, Cloud Computing. **(6)**
- **(b)** Write a program that should output the factors of the number passed as input – one factor on each line. Factors of a number, say x, are those whole numbers which can be multiplied with other whole numbers to get x. **(5)**
- **(c)** What are IDEs? How do they help in software development? List the IDEs you have ever used. **(5)**
- **(d)** Write a program in C/C++ to convert a decimal number to hexadecimal. **(4)**

Q. No. 4.
- **(a)** Explain object oriented programming paradigm. Write a detailed note on any two of the principles of object oriented programming paradigm. **(8)**
- **(b)** Why do we need interfaces in OOP? How does it help in achieving abstraction? **(6)**
- **(c)** What do you mean by runtime and compile time errors? **(6)**

SECTION-B

Q. No. 5.
- **(a)** What is a tree in data structure? Describe its types with the help of examples. **(8)**
- **(b)** What is pass by value and pass by reference? Can we pass an object as a parameter to call a method in java? **(6)**
- **(c)** Convert following infix notation to prefix **(6)**
  - (i) (30+23)*(43-21)/(84+7)
  - (ii) 2*(1+(4*(2+1)+3))

Q. No. 6.
- **(a)** Convert following NFA to DFA: **(8)**

- **(b)** Differentiate between overloading and overriding with the help of an example. **(6)**
- **(c)** What is recursion in data structures? Explain three conditions of a recursive function with the help of an example. **(6)**

Q. No. 7. **(a)** Write detailed notes on any TWO of the following: **(8)**

      i. PERT chart   **ii.** Unified Modeling Language   **iii.** AVL Trees

(b) What is a Software Process Model? Explain the Spiral model in detail. **(7)**

(c) What do you mean by software quality? List at least five quality attributes. **(5)**

Q. No. 8. **(a)** Consider the grammar **(4)**

        $S \rightarrow cAd$

        $A \rightarrow a\,b \mid a$

  construct a top-down parse tree for the input string w = cad

(b) Is the above given grammar ambiguous or unambiguous? Justify your answer. **(4)**

(c) Write similarities and differences of CFG and regular expression. **(4)**

(d) Design grammar for the following language: **(4)**

  "The set of all strings of 0s and 1s such that every 0 is immediately followed by at least one 1".

(e) Write a note on Aspect Oriented Programming **(4)**

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