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 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.
   (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)**

****