SUBJECT: COMPUTER ENGINEERING: PAPER – II (SET A)

Time: 3 Hours **Maximum Marks: 200**

Q1. Answer any ten questions. **10 × 1 = 10**

a) The FSB of a processor stands for _____.
b) For a processor with 32-bit instructions, the instruction next to the current instruction at 400 (decimal) is _____.
c) RAID stands for _____
d) The process scheduling algorithm that allocates a fixed quantum of time for each process is named _____.
e) The full form of GNU is _____.
f) When many devices that want to request for interrupts are connected in series, it is called _____.
g) In respect to a SQL database, DDL stands for _____.
h) To remove a relation from an SQL database, we use the _____ command.
i) A special type of integrity constraint in databases that relates two relations & maintains consistency across the relations is called _____.
j) VGA stands for _____.
k) CMYK colour model stands for _____.
l) Human eye cannot detect flicker of video if the frame rate is at least _____ frames per second.

Q2. Answer any ten questions. **10 × 5 = 50**

a) Consider the following sequence of micro-operations.

```
MDR ← PC
MAR ← X
PC ← Y
Memory ← MDR
```

Which operation can be performed by this sequence?

b) A RAM chip has a capacity of 1024 words of 8 bits each (1K × 8). Compute the number of 2 × 4 decoders with enable line needed to construct a 16K × 16 RAM from 1K × 8 RAM.
c) A process executes the following code.

```
fork();
fork();
fork();
```

Find out the number of child processes created and draw the process hierarchy.
d) Describe the memory hierarchy of a standard Pentium processor including its various cache types and general purpose registers.
e) Differentiate between function calls and system calls with suitable examples.
f) In respect to transactions in a database, explain briefly the ACID properties.
g) Explain deadlock in an operating system and explain how it can be avoided.
h) Explain 2NF and 3NF normalization forms with suitable examples.
i) A FAT (file allocation table) based file system is being used and the total overhead of each entry in the FAT is 4 bytes in size. Given a 100 x 106 bytes disk on which the file

system is stored and data block size is 103 bytes, find the maximum size of a file that can be stored on this disk.

j) Explain operator precedence grammar with an example.

k) Explain two common projection techniques with respect to 3-D projections.

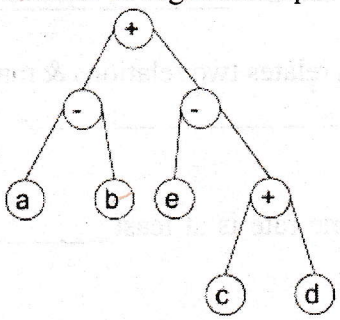
l) Distinguish between direct-mapped, set associative and fully associative cache associativity.

Q3. Attempt any ten questions. **$10 \times 8 = 80$**

a) Prove that natural join and union operations in relational algebra is both associative and commutative.

b) Explain how a bottom-up parser can detect "handles" to perform shift and reduce operations with a relevant example.

c) Consider a load-store architecture processor. Suppose the variables a, b, c, d and e initially stored in memory. Assuming no intermediate results can be stored in memory, illustrate the register allocations used during computation – and identify the minimum number of registers required.



d) Consider a four stage pipeline namely IF, ID, EX, WB. Assuming that ADD and SUB operations require 1 clock cycle while the DIV operation requires 4 clock cycles in the EX stage. Find the number of clock cycles required to complete the following instructions.

```
SUB R2, R1, R0
DIV R4, R3, R2
ADD R6, R5, R4
```

e) Illustrate how the P and V operations of a mutex can be used to solve the producer-consumer problem.

f) Compare and contrast various display adapters in terms of its features and limitations.

g) Explain how virtual memory segmentation is implemented using MMU. Can paging be combined with memory segmentation?

h) Explain how functional languages are different from procedural languages with relevant examples.

i) Distinguish between RISC and CISC architectures with examples from modern processors.

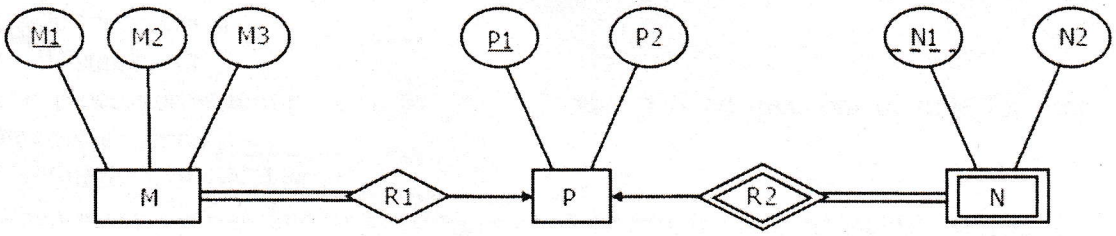
j) Convert the following ambiguous expression grammar

$$E \rightarrow E + E \mid E - E \mid E * E \mid E / E \mid (E) \mid a \mid b$$

to an equivalent unambiguous grammar.

k) Differentiate between tuple and relational calculus.

l) Consider the E-R diagram below.



Find the minimum number of tables to represent M, N, P, R1 and R2 and write the table schema.

Q 4. Attempt any four questions. **$4 \times 15 = 60$**

a) Consider the occurrence of a cache miss. Explain the various events that take place during a memory read. Clearly identify what occurs in the cache, hard disk and TLB.

b) Explain how Bresenham's line drawing algorithm avoids multiplication/division and floating point computations. Illustrate the algorithm with a relevant example.

c) A file system uses a file descriptor with 10 direct block address. 1 indirect block address and 1 doubly indirect block address. The size of each disk block is 1024 Bytes and the size of each disk block address is 4 Bytes. Compute the maximum possible file size in this file system.

d) Consider the following processes

Process	Arrival Time	Execute Time	Priority
P0	0	5	1
P1	1	3	2
P2	2	8	1
P3	3	6	3

Compute the average waiting time for each process for the following scheduling algorithms:

i) First Come First Serve
ii) Shortest Job Next
iii) Priority Scheduling
iv) Shortest Remaining Time
v) Round-robin scheduling

e) Prove that the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$ cannot be parsed by any syntax analyzer. Can you design an abstract machine that will recognize this language?