

ID No. 16CP022

**Birla Vishvakarma Mahavidyalaya (Engineering College)**  
*(An Autonomous Institution)*

**Third Year, B.Tech. (Computer Engineering)**  
**End Semester Examination - Winter 2018**

**Course Code: CP302**

**Course Title: Design and Analysis of Algorithms**

**Date: 24.11.2018**

**Time: 02:30 pm to 05:30 pm**

**Maximum Marks: 70**

**Instructions:**

- Each section must be written in a separate answer books.
- Numbers to the right indicate maximum marks.

**Section – I**

Q. 1 (a) Consider the following functions:

$$f(n) = 2^n, g(n) = n! \text{ and } h(n) = n^{\log n}$$

Which of the following statements about the asymptotic behavior of  $f(n)$ ,  $g(n)$  and

$h(n)$  is true? Justify your answer. [04]

- a)  $f(n) = O(g(n))$  &  $g(n) = O(h(n))$
- b)  $f(n) = \Omega(g(n))$  &  $g(n) = O(h(n))$
- c)  $g(n) = O(f(n))$  &  $h(n) = O(f(n))$
- d)  $h(n) = O(f(n))$  &  $g(n) = \Omega(f(n))$

(b) Derive worst case and best case partitioning complexity of quick sort. [05]

**OR**

Derive the recurrence for merge sort and solve it using recursion tree.

(c) Explain Master Theorem. [03]

Q. 2 (a) Suppose there are 5 jobs to execute, each of which takes unit time. Job  $i$  earns profit  $g_i$  if and only if it is executed before its deadline  $d_i$ . Apply Scheduling algorithm to find optimum schedule. [04]

i	1	2	3	4	5
$g_i$	20	15	10	5	1
$d_i$	2	2	1	3	3

(b) Given four matrices  $A_1$  ( $5 \times 4$ ),  $A_2$  ( $4 \times 6$ ),  $A_3$  ( $6 \times 2$ ) and  $A_4$  ( $2 \times 7$ ). Find the optimal sequences for the computation of multiplication operation. [07]

**OR**

Compute Longest common subsequence for below strings.

S1: b a c b f f c b

S2: d a b e a b f b c

Q. 3 (a) Explain greedy algorithm. (First Fit and Worst Fit) for following processes. Requirement and available block. [06]

- ```

blockSize[] = {100, 500, 200, 300, 600};
processSize[] = {212, 417, 112, 426};

(b) Give Complexity of following code snippet, show details. [06]
1. for (int i = 2; i <=n; i = pow(i, k))
   // some O(1) expressions or statements
2.
int a = 0;
for (i = 0; i < N; i++)
   for (j = N; j > i; j--)
      a = a + i + j;

3. int a = 0, i = N;
while (i > 0) {
   a += i;
   i /= 2;
}

```

Q. 4

**Section – II**

A farmer has 150 acres of land on which he wants to grow cotton and potatoes. Government restrictions prevent the farmer from devoting more than 60 acres of land to cotton, but he can use as much acres for potatoes as he wishes. It requires 30 inches per acre of water for irrigation to grow cotton and 15 inches per acre to grow potatoes. The farmer has 3000 acre-inches of water available. If the farmer's profit per acre is \$207 for cotton and \$200 for potatoes, how many acres of cotton and how many acres of potatoes should he grow in order to obtain the largest possible profit from his land?

- (a) Formulate the above problem mathematically. [03]
- (b) Draw the graphical model and find at least three boundary points. [03]
- (c) Find the optimal solution. [03]
- (d) Reduce the following 3-SAT in to vertex cover problem. What is k (number of vertex in vertex cover) [04]

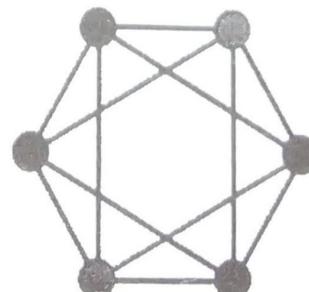
Q. 5

$$(X_1 \vee X_1 \vee X_2) \wedge (\neg X_1 \vee \neg X_2 \vee \neg X_2) \wedge (\neg X_1 \vee X_2 \vee X_2)$$

Answer the following questions. (Any four)

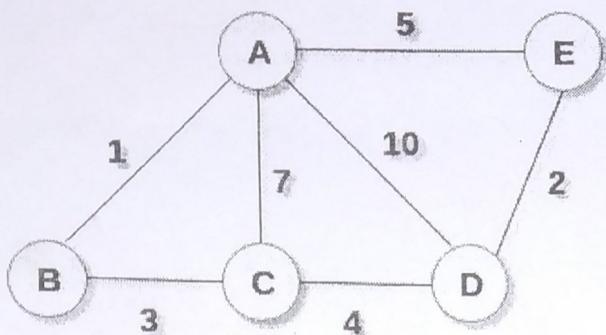
[12]

1. Explain Clique problem and give one example of 3 clique graph.
2. Give steps of reducing SAT problem into 3-SAT problem with example.
3. What is graph Coloring problem? Color the following graph vertices using 3 colors.



4. The rook is a piece that may move any number of spaces either horizontally or vertically per move. Design an algorithm to place 4 rooks on 4x4 chess board.
5. Find Minimum Spanning tree using kruskal algorithm for following

graph.



- Q. 6 (a) What is spurious hits in Rabin Karp algorithm? Find 2 Spurious hits for the [03] given data.

$$T = 31415926535 \text{ and } P = 26$$

$$q = 11 \text{ ( } X \bmod 11 \text{ )}$$

- (b) For effectively sending information to entire class, you are told to find different groups in the class which are not connected to each other. Following are 10 students in the class. Explain algorithm and data structure required to achieve given task. [07]

a <-> b , b <-> d , c <-> f , c <-> I, j <-> e ,g <-> j, h <-> h

**Birla Vishvakarma Mahavidyalaya (Engineering College)**  
*(An Autonomous Institution)*

**Third Year, B. Tech. (Computer Engineering)**  
**End Semester Examination – Winter 2018**

**Course Code: CP303****Course Title: Object Oriented Programming using JAVA****Date: 27.11.2018****Time: 02.30 pm to 05.30 pm****Maximum Marks: 70****Instructions:**

Each section must be written in separate answer book.

Numbers to the right indicate maximum marks.

Make suitable assumption(s) if required, by stating that clearly.

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**Section – I**

- Q. 1 (a) Answer any three. [09]
- 1 Java is machine independent whereas JVM is machine dependent. Justify.
  - 2 In Java, there is no operator similar to sizeof of C++. Justify.
  - 3 Explain shift right operators.
  - 4 Explain need of having native methods in Java.
- (b) Write a recursive method to compute  $x$  raised to power  $y$  by doing repeated multiplication. Also define main. [03]
- Q. 2 (a) Discuss following keywords with example(s): (i) super (ii) final  
OR OR OR [05]
- (a) Explain garbage collection in Java. Also discuss the use of finalize() method. [05]
- (b) It is required to compute SPI (semester performance index) of  $n$  students of a class for their registered subjects in a semester. Assume that all students register for 5 subjects and each subject carry 5 credits. Declare a class called student having following data members: id\_no, grades\_obtained and spi. Define constructor, display and calculate\_spi methods. Define main to process data of  $n$  students and display details of students having spi greater than 6.  
Note: Assume grading system of BVM. [07]
- Q. 3 (a) Explain needs and usefulness of packages. Show how to create and use a sub-package. [05]
- (b) Declare a class called employee having members like name, basic\_salary and perks. Have an abstract member method compute\_salary. Extend it to have two sub classes called clerk and manager. The clerk class has members like overtime\_salary and gross\_salary. The manager class has a member gross\_salary. Override the method compute\_salary to calculate gross salary for both extended classes. For manager, gross salary is a total of basic salary and perks. For clerk, the gross salary is a total of basic salary, perks and overtime salary. Show usage of dynamic method dispatch (run-time polymorphism) by creating array of objects of both types. Raise and handle exception if gross salary is more than 30000 and less than 50000. Have user defined exception handler. [06]

## Section - II

- Q. 4 (a) Attempt any three. [09]  
1 Explain by giving an example usage of keyword throws.  
2 Why do you use keyword volatile? Give an example.  
3 Explain use of adapter classes.  
4 Explain event delegation model.  
5 Explain needs of wrapper classes of Java.
- (b) Explain the usage of interface. [03]
- Q.5 (a) Explain life cycle of an Applet and list the frequently used methods. [05]  
(b) Declare a class called Buffer having three int data members, to be used as counters which are all initialized with zero. One counter corresponds to one child-thread. So, create three child-threads having same priority. Each child-thread increments the corresponding counter value by one as and when scheduled for execution and then enters into block state after notifying all other child-threads. The main thread enters into sleep state for 3 seconds after creating three child threads. All child threads are to be terminated when main thread is re-scheduled for execution after the period of sleep. Display the counter values before terminating the main thread. Write a complete program to meet above requirements. [07]
- Q.6 (a) List and describe any two methods of class File or FileInputStream. [04]  
(b) Write a complete program to implement a priority queue using linked list of nodes containing an int information. You may either use appropriate class/methods of util package or write your own class/methods or combination of both. Assume int information value also reflect the priority of corresponding node. [07]  
Design and draw GUI of your choice to add and remove elements. Also write corresponding code for the same.

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ID No. 16 CP022

**Birla Vishvakarma Mahavidyalaya (Engineering College)**

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**Third Year, B. Tech. (Computer Engineering)**

**End Semester Examination - Winter 2018**

**Course Code: CP301**

**Course Title: Web Technologies**

**Date: 20.11.2018**

**Time: 02:30 pm to 05:30 pm**

**Maximum Marks: 70**

**Instructions:**

- Each section must be written in a separate answer books.
- Numbers to the right indicate maximum marks.

**Section – I**

Q. 1 (a) Answer the following questions. [05]

1. Each resource in Internet is identified by
  - i. MAC address
  - ii. IP address
  - iii. Device address
  - iv. None of the above
2. Which of the following is not an Email related protocol?
  - i. SMTP
  - ii. POP3
  - iii. TCP
  - iv. All are email protocol
3. Which of the following HTTP error code indicates page not found?
  - i. 404
  - ii. 200
  - iii. 500
  - iv. None of the above
4. Web document root for HTML, PHP in XAMPP is
  - i. \xampp\php\
  - ii. \xampp\htdocs\
  - iii. \xampp\root\
  - iv. None of the above
5. Which of the following indicates local access to the web server?
  - i. http://127.0.0.1
  - ii. http://localhost
  - iii. Any of the above.
  - iv. None of the above

- Q. 2 (b) Draw the architecture of web browser and explain function of each component. [05]
- Q. 2 (a) Explain HTTP GET request and corresponding response with the help of an example. [05]
- Q. 2 (b) List new features of HTML5 and explain importance features with example. [05]

**OR**

- Q. 3 (b) List various Web site design issues. Discuss design issues related to software and hardware environments. [05]
- Q. 3 (a) Show the use of various attributes with HTML table tags. [05]
- Write a HTML file to create following table format.

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

- (b) (i) Differentiate between internal and inline style-sheets with example. [02]  
(ii) Write an external style-sheet for the following rules. [03]
  - To make all the headers with normal font and having size 150%.
  - To display all the paragraphs in Arial font with bold style.
  - To make the background color red.

- (c) (i) What is z-index in CSS? Show its use with example. [02]  
(ii) What is gradient? Explain linear and radial gradients with examples. [03]

**OR**

- (c) (i) Consider the following CSS. Give the meaning and effect when it applies to a paragraph in your page. [02]

```
< Style type="text/css">
p.margin {
margin: 2cm 2cm 1cm 2cm;
border: thick solid red;
padding-top: 0.5%
}
</style>
```

- (ii) What is CSS3? List its features and explain any one. [03]

## Section - II

- Q. 4 (a) What is DOM in JavaScript? List out the important objects in Dom. Discuss the different methods and properties that are available on the window.history object. [05]

- (b) Write a JavaScript for, "if the user remains idle (no keyboard and mouse events) for 1 minute then web page is redirected to another page (*logout.html*)". [05]

- Q. 5 (a) (i) Write an XML file *marksheet.xml* representing your semester mark sheet. [02]  
Make the element mark sheet, a root element having the sub elements name, exam\_no, semester, branch, subject (having its sub elements sub\_name, sub\_obt; repeat it for all the subjects of semester), total marks.

- (ii) Write a *marksheet.xsl* file to display above *marksheet.xml* in tabular format. [03]

- (b) Differentiate between DTD and schema for XML. [05]

**OR**

- (b) Write a regular expression for the following: [05]
  - An email address
  - A telephone number.
  - Name of person
  - Age
  - Price up to 2 decimal digits

- Q. 6 (a) (i) What is foreach loop in PHP? Show its use with example. [02]  
(ii) Explain the use if `$_GET[]`, `$_POST[]` and `$_REQUEST[]` array in PHP. [03]

- (b) Write a PHP code to insert a row into a student table having columns `std_id` (integer), `std_name` (string) and `marks` (float). Give all the steps right from

connecting to selecting database and inserting the row.

- (c) What is cookies? How can you set, access and delete the cookies? Give example [05] for all.

OR

- (c) What is session? Discuss about starting and maintaining session in PHP. [05]

**Birla Vishvakarma Mahavidyalaya (Engineering College)**  
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**Third Year Fifth Sem. B.Tech. (Computer) - End Semester Examination - Winter 2018**

**Course Code:** CP304

**Date:** 29/11/2018

**Course Title:** Processor Architecture

**Time:** 2:30 pm to 5:30 pm

**Maximum Marks:** 70

**Instructions:**

- Each section must be written in a separate answer books.
- Numbers to the right indicate maximum marks.
- Make suitable assumptions whenever required and mention it clearly

**Section – I**

- Q. 1 (a) Answer the following questions (any six) [12]
1. What are the advantages of segmentation?
  2. Explain addressing mode of following instructions. Also find physical address generated to get data when this instruction is executed  
MOV AX,2300H and MOV AX,[2300h]  
Assume CS=1200H, DS=5000H, SS=6000H
  3. If AL reg. contains -5 then what will be the binary contents of AX after executing the CBW instruction
  4. What is prefetch queue? What is its significance? What happens when branch instruction comes?
  5. What would be the physical address after reset in 8086 microprocessor? Why?
  6. Write necessary instructions to set TRAP flag in 8086?
  7. What is the use of LOCK pin and TEST pin of 8086?
- Q 2 (a) Write an 8086 assembly programed (Any One) [06]
1. Write a near procedure which compares two 32 bit numbers and return 0 if they are equal, return 1 if first number is greater than second and return 2 if first number is less than second. Write a main program which finds out maximum number from a given array of 32bit numbers using above procedure.
  2. What is the role of direction flag in string instructions? Write a program to replace 'X' with 'T' in a given string "GUJARAX XECH UNIVERSIXY". Use string instructions only.
  3. Write an 8086 assembly program to reverse the array of 10 numbers stored in data segment using stack.
- (b) What are the differences between minimum mode and maximum mode of 8086? Draw 8086 minimum mode configuration showing address/data demultiplexing, even and odd bank of memory (show its memory map) and one I/O port. [06]
- Q 3 (a) Write down the steps followed by 8086 when INT 2 instruction is executed. [03]
- (b) Briefly explain various methods of passing parameters to and from procedure with their merits and demerits. Define the term reentrant and explain how you must pass parameters to a procedure so that it is reentrant procedure. [06]
- (c) Why does 8086 automatically disable INTR interrupt when responds to any interrupt? [02]

**OR**

- (c) Compare procedure and macro [02]

## Section II

- Q. 4 (a) How do 80386 or Pentium switches from real mode to protected mode? Briefly explain the process of converting logical address to physical address in MMU of Pentium or 80386? What is the size of each segment in protected mode? [05]
- (b) Briefly explain handling of interrupts in protected mode of 80386. Briefly explain protection of I/O in protected mode of 80386. [05]
- Q 5 (a) Answer the following questions (Any Two) [08]
1. Briefly explain Superscalar architecture and different data Hazards in Superscalar architecture. Briefly explain solutions used to deal with these hazards
  2. Briefly explain three different types of Multithreaded processor
  3. What are control hazards in pipelining architecture? Briefly explain the different approaches used to reduce the delay due to control hazards
  4. Briefly explain Very long instruction word (VLIW) processor. Compare them with superscalar architecture
- (b) Explain how the 80386 can address a virtual space of 64TB when the physical memory location contains only 4GB of memory [02]
- (c) Briefly explain different ways to represent real data in 8087. Represent 178.625 in long real format of 8087 [03]
- Q 6 (a) Answer the following questions (Any Three) [12]
1. What are the advantages of Multicore architecture? With the help of block diagram explain Intel core Duo and Intel core I7 multicore architecture
  2. Briefly explain segment descriptor and Gate descriptor. Briefly explain the use of Gate descriptor
  3. Show the interfacing of 8087 with 8086. Also discuss communication between 8086 and 8087
  4. Consider the sequence of machine instructions given below:  
MUL R5, R0, R1  
DIV R6, R2, R3  
ADD R7, R5, R6  
SUB R8, R7, R4  
  
In the above sequence, R0 to R8 are general purpose registers. In the instructions shown, the first register stores the result of the operation performed on the second and the third registers. This sequence of instructions is to be executed in a pipelined instruction processor with the following 4 stages: (1) Instruction Fetch and Decode (IF), (2) Operand Fetch (OF), (3) Perform Operation (PO) and (4) Write back the Result (WB). The IF, OF and WB stages take 1 clock cycle each for any instruction. The PO stage takes 1 clock cycle for ADD or SUB instruction, 3 clock cycles for MUL instruction and 5 clock cycles for DIV instruction. The pipelined processor uses operand forwarding from the PO stage to the OF stage. Draw the pipeline diagram and find out the number of clock cycles taken for the execution of the above sequence of instructions
  5. Briefly explain four new features of Pentium processor compared to 80386 processor

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**Birla Vishvakarma Mahavidyalaya (Engineering College)**  
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**Third Year Fifth Sem. B.Tech. (Computer) - End Semester Examination - Winter 2018**

**Course Code:** CP305

**Course Title:** Operating Systems

**Date:** 01/12/2018

**Time:** 10:30 am to 1:30 pm

**Maximum Marks:** 70

**Instructions:**

- Each section must be written in a separate answer books.
- Numbers to the right indicate maximum marks.
- Make suitable assumptions whenever required and mention it clearly

**Section – I**

- Q. 1 (a) Answer the following questions (Any Three) [06]
- 1 What are the differences between timesharing and multiprogramming systems?
  - 2 What is the biggest advantage of implementing threads in user space? What is the biggest disadvantage?
  - 3 Which property of Monitor makes them useful for achieving mutual exclusion?  
Why monitor is called higher level synchronization primitive
  - 4 Explain how time quantum value and context switching time affect each other, in a round-robin scheduling algorithm.
  - 5 Consider a real-time system with two voice calls of periodicity 5 msec each with CPU time per call of 1 msec, and one video stream of periodicity 33 ms with CPU time per call of 11 msec. Is this system schedulable?
- (b) What is system call? Explain steps for system call execution. [04]

- Q 2 (a) Consider the following five processes with the length of the CPU burst time in milliseconds. [06]

| Process | Burst Time | Priority |
|---------|------------|----------|
| P1      | 10         | 3        |
| P2      | 1          | 1        |
| P3      | 2          | 5        |
| P4      | 3          | 4        |
| P5      | 5          | 2        |

Processes are Assumed to have arrived at time 0. For the above set of processes find the average waiting time and average round time for each of the following scheduling algorithm using Gantt chart. Consider 1 is highest priority.

1. SJF 2. Non preemptive Priority 3. RR ( Q = 2)

- (b) Consider the following reference string. Calculate the page fault rates for below page replacement algorithms. Assume the memory size is 3 page Frames. [06]
- 1, 2, 3, 2, 4, 1, 3, 2, 4, 1  
 1. FIFO    2. OPTIMAL 3. LRU (

- Q 3 (a) Briefly explain local and global page replacement policy with their advantages and disadvantages. Does number of page frames allocated to process remain same in case of global page replacement policy? Does global page replacement policy cause thrashing? Justify your answer [05]

(b) Answer the following questions (Any Two) [08]

- (1) Consider a swapping system in which memory consists of the following hole sizes in memory order: 15K, 5K, 20K, 4K, and 7K. Which hole is taken for successive segment requests of:

(a) 12K (b) 7K (c) 15 for first fit? Now repeat the question for best fit, worst fit, and next fit

- (2) Using the page table shown below, translate the physical address 25 to virtual address. The address length is 16 bits and page size is 2048 words while the size of the physical memory is four frames.

| Page | Present<br>(1 in, 0 out) | Frame |
|------|--------------------------|-------|
| 0    | 1                        | 3     |
| 1    | 1                        | 2     |
| 2    | 1                        | 0     |
| 3    | 0                        | -     |

- (3) Suppose that the WSClock page replacement algorithm uses a  $\tau$  of two ticks, and the system state is the following:

| Page | Time stamp | V | R | M |
|------|------------|---|---|---|
| 0    | 6          | 1 | 0 | 1 |
| 1    | 9          | 1 | 1 | 0 |
| 2    | 9          | 1 | 1 | 1 |
| 3    | 7          | 1 | 0 | 0 |
| 4    | 4          | 0 | 0 | 0 |

Where the three flag bits V, R, and M stand for Valid, Referenced, and Modified, respectively. Suppose that, a page fault occurs at tick 10 due to a read request to page 4. Show the contents of the new table entries. Explain.

- (4) A computer has four page frames. The time of loading, time of last access, and the R and M bits for each page are as shown below (the times are in clock ticks): Algorithms are executed independently

| Page | Loaded | Last ref | R | M |
|------|--------|----------|---|---|
| 0    | 126    | 280      | 1 | 0 |
| 1    | 230    | 265      | 0 | 1 |
| 2    | 140    | 270      | 0 | 0 |
| 3    | 110    | 285      | 1 | 1 |

- (a) Which page will NRU replace?  
 (b) Which page will FIFO replace?  
 (c) Which page will LRU replace?  
 (d) Which page will second chance replace?

## Section - II

- Q. 4** (a) Briefly explain FAT and Inode based file system. Also discuss implementation of directory in windows and Unix operating system. [06]  
 (b) Explain the difference between internal fragmentation and external fragmentation. Which one occurs in paging systems? Which one occurs in systems using pure segmentation? Briefly explain the advantages of segmentation [05]
- Q 5** (a) Answer the following questions (Any Two) [12]  
 (1) An operating system uses the Banker's algorithm for deadlock avoidance when managing the allocation of three resource types X, Y, and Z to three processes P0, P1, and P2. The table given below presents the current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution. There are 3 units of type X, 2 units of type Y and 2 units of type Z still available. The system is currently in a safe state. Consider the following independent requests for additional resources in the current state:

| Process | Allocation |   |   | Max |   |   |
|---------|------------|---|---|-----|---|---|
|         | X          | Y | Z | X   | Y | Z |
| P0      | 0          | 0 | 1 | 8   | 4 | 3 |
| P1      | 3          | 2 | 0 | 6   | 2 | 0 |
| P2      | 2          | 1 | 1 | 3   | 3 | 3 |

REQ1: P0 requests 0 units of X, 0 units of Y and 2 units of Z

REQ2: P1 requests 2 units of X, 0 units of Y and 0 units of Z

Which one of the following is TRUE?

- (A) Only REQ1 can be permitted.
- (B) Only REQ2 can be permitted.
- (C) Both REQ1 and REQ2 can be permitted.
- (D) Neither REQ1 nor REQ2 can be permitted

Show all calculations

- (2) Suppose a disk has 200 cylinders numbered from 0 to 199. At some time, disk arm is at cylinder 76 and there is a queue of disk access requests for cylinders: 54, 32, 108, 22, 67, 77, 88, 42, 82. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms? Assume that SCAN algorithm moves towards 199 when it starts execution
- (i) Shortest seek first (SSF) (ii) SCAN (Elevator) (iii) CSCAN (iv) LOOK
- (3) Briefly explain the methods used by an operating system to keep track of free blocks. Suppose that disk addresses require D bits. For a disk with a total of B blocks, F of which are free, state the condition under which the free list uses less space than the bit map. For D equal to 16 bits, express your answer as the percentage of disk space that must be free.

Q 6

Answer the following questions (**Any Three**)

[12]

1 What do you mean by a file system consistency? File system checker can also be used to check files and directories. Suppose that the following table is constructed:

I-node number: 0 1 2 3 4 5 6 7 8 9

File count: 1 2 0 1 0 0 1 1 0 0

I-node count: 1 1 0 1 1 0 1 1 0 0

The file count is obtained by traversing from the root directory and computing the number of times an i-node is used by a file. The i-node count is just the link counts stored in each i-node. Are there any errors? If so, how serious are they, and how can they be fixed?

- 2 Briefly explain protection mechanism used in operating systems. Also discuss Access control list and Capabilities.
- 3 Briefly explain four layers of the I/O software system and functions of each layer
- 4 How can Deadlock be prevented in Operating systems? Briefly discuss
- 5 Why page size should not be too large not too small. For the implementation of a paging scheme, suppose the average process size be  $x$  bytes, the page size be  $y$  bytes, and each page entry requires  $z$  bytes. Derive the equation of optimal page size
- 6 Computer system implements 8 kilobyte pages and a 32-bit physical address space. Each page table entry contains a valid bit, a dirty bit three permission bits, and the translation. How many bytes are required for page table entry? If the maximum size of the page table of a process is 24 megabytes, What will be the length of the virtual address supported by the system?

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