Question 1

(a) Consider a disk of B blocks, F of which are free and that a disk address size requires D bits. Free disk blocks can be tracked using either a linked list or a bitmap. Write down the condition under which the free list uses less space than the bitmap in terms of B, F and D.

(b) Suppose that the free list or bitmap of free disk blocks was completely destroyed due to a crash.
(i) Explain how the free list can be recovered if the file system uses i-nodes.
(ii) Does this problem occur in a file system using a file allocation table? Explain.

(c) Explain what is meant by a journaling file system.

(d) Consider a file whose size varies between 4Kb and 4MB during its lifetime. State, with a reason, whether or not the following allocation schemes will be appropriate for implementing the file storage: contiguous allocation, linked list allocation, file allocation table

(e) In the case of an external USB hard drive attached to a computer, which is more suitable a write-through cache or nonwrite-through cache.

(f) Write down the average access time for a disk cache given that the h% of the time it takes 1ms to satisfy a request from the cache, and that 75ms is needed to satisfy a request if a disk read is necessary.

Question 2

(a) Explain how an operating system can support multiple file systems.
(b) Differentiate between precise and imprecise interrupts

Question 3

Suppose that a disk drive has 200 cylinders, numbered 0 to 199. The current position of the head is at cylinder 30 and the head is moving in the direction of increasing cylinder number.
The queue of pending requests, in first-in-first-out order, is 109, 190, 48, 123, 21, 135, 75, 77, 29

For each of the following disk scheduling algorithms, produce a list of the order in which the requests are carried out, and calculate the total distance (in cylinders) that the head moves to satisfy all the pending requests. Show all working.

(a) FCFS (First-Come, First-Served) [3 marks]
(b) SSTF (Shortest-Seek-Time-First) [3 marks]
(c) C-SCAN (Circular Scan) [3 marks]
(d) C-LOOK (Circular Look) [3 marks]

Submission instructions:

- Work in groups of 5.
- Submit one assignment per group
- Ensure each student id and name is included
- Upload a pdf or word file containing your solutions before the deadline date.