1. (10) A disk drive has 200 cylinders. The following requests come to access the disk. (Each number represents a cylinder.)

20, 140, 180, 100, 60, 120, 40

List five different disk scheduling methods and show graphically the order in which the above cylinders are accessed.

See book for example diagrams.

Method: ____ FCFS – first come first served. ___

Method: ____ SSTF – shortest seek time first ___

Method: ______ SCAN __________

Method: ______ C-SCAN _________

Method: ______ LOOK ___________
2. (5) A system has three processes (P₁, P₂, P₃) and three resources (R₁, R₂, R₃). This are two instances of R₁. There is one instance of R₂. There are three instances of R₃. P₁ holds an R₁ and an R₃ and is requesting an R₂. P₂ holds an R₁ and an R₂ and is requesting an R₃. P₃ holds an R₃ and is requesting an R₂. Draw the resource allocation graph for this situation. Does a deadlock exist?

Deadlock does not exist.

3. (2) Can the presence or lack of a cycle in a resource graph be used to determine whether a deadlock exists or whether it doesn’t exist? Explain.

(Required) If there’s no cycle, there’s no deadlock. A cycle may or may not mean a deadlock is present.

(Optional) If there is only one resource of each type, a cycle implies a deadlock.
4. (11) A computer has 40 bytes of memory organized into 10 byte blocks. The following addresses are accessed in the order specified:

21, 61, 65, 14, 20, 17, 32, 45, 66, 70, 58, 39, 13, 41

How many pages of memory are accessed? 7

How many frames of memory are accessed? 4

Name, describe and show the operation of three memory subsystem algorithms.
First-in, first out. Frames allocated in order as need. Least recently allocated page is one removed if a new frame is needed.

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5. (3) List two factors which affect how long it takes to retrieve data off the disk drive. Which is the limiting factor?
Positioning the read head, the rotation of data underneath the read head, the electronic transfer of data to the computer. Moving the read/write head back and forth takes the longest amount of time.

6. (1) A memory subsystem has a memory access time of 1000 nanoseconds and a page fault time of 40 milliseconds (30,000,000 nanoseconds). If the probability of a page fault is 0.4, what is the effective access time?

(1 - 0.4) * 1000 + 0.4 * 30,000,000 ns or 16 ms

7. (8) List and describe four conditions in an operating system are necessary for a deadlock to occur?
Mutual exclusion -- two processes cannot use resource at same time
No preemption -- once a resource is allocated to process it is not removed until process releases it
Circular wait - a process is waiting for resource held by another process which, directly or indirectly, is waiting for a resource the first process is holds.
Hold and wait -- a process is allowed to hold onto existing resources while waiting for additional resources to be allocated.
8. (3) List and describe three ways an operating system can handle deadlocks. Do not include manual deadlock (e.g. let the operator take can of it) management.
   Prevention -- allocate resources in such a way that deadlock cannot occur
   Avoidance -- evaluate system state prior to allocating resources; don't allocate if a deadlock may occur.
   Detection and recovery -- periodically examine state of system to see if deadlock is present. If so, rollback one of the processes involved in the deadlock.

9. (1) Describe the purpose of a constructor in C++.
   Allocate resources and initialize values.

10. (6) List and describe 3 methods of allocation (organization) of disk blocks.
    Contiguous -- files are on blocked together.
    Linked -- each data block contains link to the next data block.
    Indexed -- separate blocks contain locations of data blocks