

2011 A/L

1. Which of the following statements best describes the result of hard disk “fragmentation”?
 - 1) Hard disk data access speed is reduced.
 - 2) Network access speed becomes slow.
 - 3) Hard disk becomes totally inaccessible.
 - 4) Some data will get erased from the hard disk.
 - 5) Number of bad sectors get increased.
2. Consider the following statements about operating systems:
 - A. Ubuntu is an open source operating system.
 - B. Windows XP is a proprietary operating system.
 - C. Linux is a proprietary operating system.
 - 1) A only
 - 2) B only
 - 3) C only
 - 4) A and B only
 - 5) A and C only

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3. The type of operating system that is most suitable for an automated air traffic control system is
 - 1) Multi-user multi-tasking
 - 2) Single-user multi-tasking
 - 3) Real time
 - 4) Single-user single-tasking
 - 5) Multi-threading
4. The main advantage of creating more than one partition in a hard disk is the
 - 1) Separation of the operating system and program files
 - 2) Ability to retrieve files efficiently.
 - 3) Easiness of making directories and subdirectories.
 - 4) Easiness of creating multiple users.
 - 5) Easiness of taking backups of selected files.

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5. Sharing a single microprocessor among number of application programs using context switching is known as
- 1) Multi-user processing
 - 2) Multitasking
 - 3) Multiprocessing
 - 4) Batch processing
 - 5) Online processing

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6. Which of the following is **not** a main function of an operating system?
- 1) Memory management
 - 2) Process Scheduling
 - 3) File Handling
 - 4) Virus Detection
 - 5) User Interface
7. In an operating system, moving a process from the main memory to the secondary storage in order to bring in another process to the main memory is called
- 1) Demand Paging
 - 2) Context Switching
 - 3) Swapping
 - 4) Interrupting
 - 5) Scheduling

2016 A/L

8. In an operating system, suspending the currently executing process and then resuming or starting another process is termed as
- 1) Paging
 - 2) Context switching
 - 3) Swapping
 - 4) Interrupting
 - 5) Blocking

9. In modern operating systems, the scheduler determines the transition of processes from the new state to the ready state.

- 1) Mid-term
- 2) Long-term
- 3) Very long-term
- 4) Very short-term
- 5) Short-term

2019 A/L

10. Which of the following is not an information stored in a Process Control Block (PCB) of the operating system?

- 1) Free disk slots (free disk blocks that could be utilized by the process)
- 2) Memory management information for the process
- 3) Program counter (address of the next instruction to be executed for the process)
- 4) Process identification number (unique identifier for the process)
- 5) Process state (e.g. Blocked, Ready etc.)

2020 A/L

11. The Operating System (OS) is another program that runs on the computer that has some special responsibilities. Memory management, file management and input/output management are some of these responsibilities. What is another important responsibility of the OS?

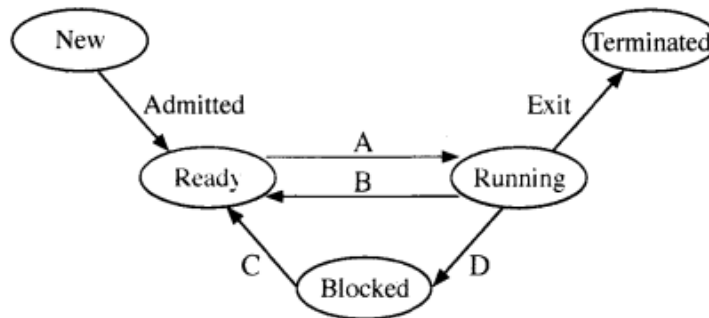
- 1) Backup management
- 2) Cache memory management
- 3) Compiler management
- 4) Process management
- 5) Some clock management

12. When the number of *processes* started by a user on a single –processor computer increases, what happens to the response time of each process as perceived by the user and the memory management related work of the operating system respectively?
- 1) Both the response time and the memory management related work increase.
 - 2) Response time decreases while the memory management related work increases.
 - 3) Response time increases while the memory management related work decreases.
 - 4) Both the response time and the memory management related work decreases.
 - 5) There is no change in either of them.
13. Which of the following is **not** a responsibility of the Operating System?
- 1) Allocating physical memory to processes
 - 2) Deciding which process to run
 - 3) Keep track of the usage of compiled program files on a hard disk
 - 4) Keep track of which parts of physical memory are in use, which are free
 - 5) Swapping processes between physical memory and disk
14. In a computer, the size of a user program could exceed the size of physical memory. Also, only the demanded areas of programs are kept in physical memory.
- 1) The use of cache memory
 - 2) The use of contiguous file allocation
 - 3) The use of a file allocation table (FAT)
 - 4) The use of Memory Management Unit (MMU)
 - 5) The use of pages, frames and page tables

2021 A/L

15.

Amara logs into a single-processor computer and starts a program to work on his presentation. He opens up a web browser too to get some information as well. Consider the following process state transition diagram with respect to the process corresponding to Amara's **presentation program**.



Consider some reasons for above state transitions:

Reason	Description
1	Amara saving his presentation on the hard disk
2	Operating system scheduling the presentation process to run on the processor
3	Operating system suspending the presentation process to let the web browser process to run on the processor
4	The finishing of saving the presentation on the hard disk

Which of the following gives a correct combination of reasons for transitions A to D?

- (1) A – 1, B – 2, C – 3, D – 4 (2) A – 2, B – 3, C – 4, D – 1
(3) A – 3, B – 4, C – 1, D – 2 (4) A – 4, B – 1, C – 2, D – 3
(5) A – 4, B – 1, C – 3, D – 2

16. A page table is

- 1) A computer hardware unit through which all memory references pass.
- 2) A data structure that keeps information about the pages that are in processor caches.
- 3) A hardware component in memory that facilitates page movement.
- 4) An operating system data structure that keeps virtual to physical address mapping of a process' pages.
- 5) A piece of processor hardware that keeps a count of the number of pages of a process that are in virtual memory.

17.

The *block size* of a disk is 4KB. A portion of its **File Allocation Table (FAT)** at a particular time is shown below. The portion shown gives the blocks of the *myprog.py* file as well.

FAT

100	101
101	-1
102	
103	100
104	

Notes: 1. The last block of a file is indicated by -1.

2. The *directory entry* of a file contains the block number of the first block of the file.

Which of the following gives the *directory entry* for the *myprog.py* file **and** the disk space allocated for the *myprog.py* file respectively?

- (1) 100, 12KB (2) 101, 12KB (3) 101, 16KB (4) 103, 12KB (5) 103, 16KB

2011 A/L

1.

- a. Encircle the most suitable entry in the second and third columns corresponding to the properties listed in the first column of the following table with respect to FAT 32 and NTFS file systems.

	FAT32	NTFS
Maximum file size	limited/unlimited	limited/unlimited
Maximum file name length	limited/unlimited	limited/unlimited
Security	yes/no	yes/no
Support of Unicode	yes/no	yes/no

- b. A computer has an 18-bit virtual memory address space where six bits are used for a page address.
- Calculate the total number of pages defined by the above addressing scheme.
 - Consider the following virtual memory address:
010111000000111100
What is the page and displacement (Offset) of this address?
 - Draw the operating system process transition diagram from process creation to termination.

2012 A/L

1.

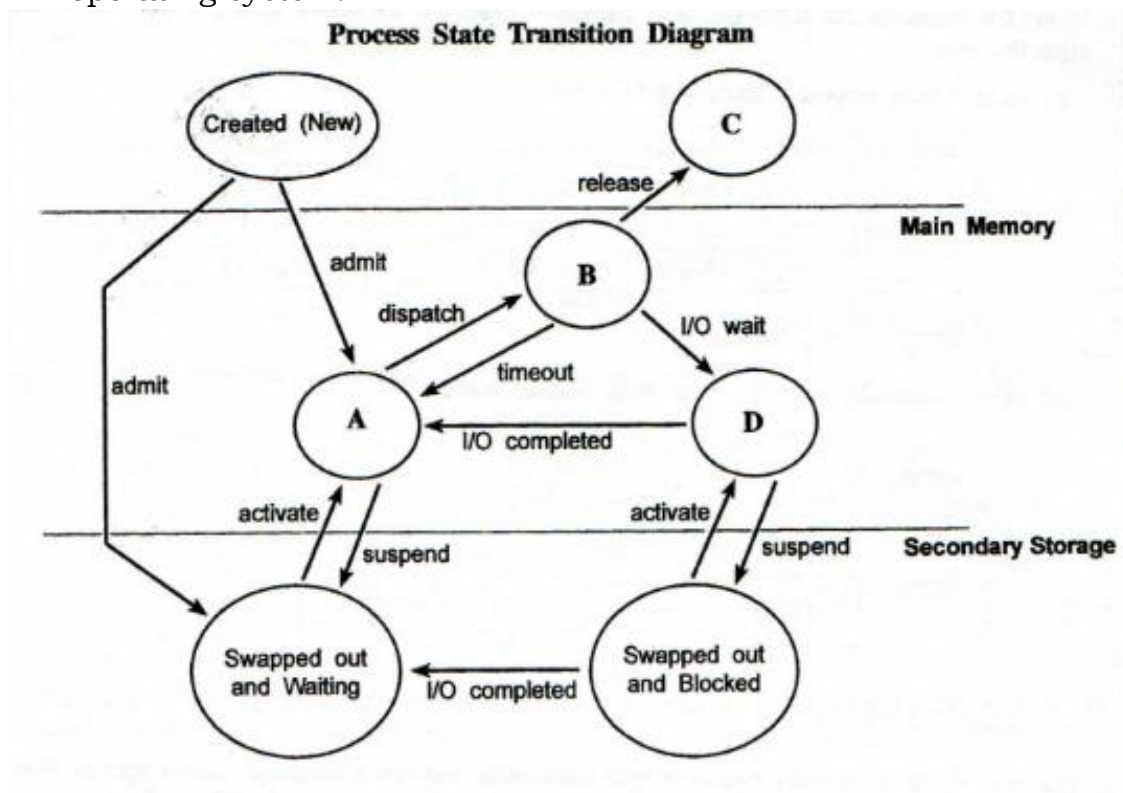
- (a) Give two techniques used in operating systems to optimize processor utilization.
- (b) In an operating system, a process can be in one of the states, namely, created/new, waiting, running, terminated, blocked, swapped out and waiting, or swapped out and blocked. From which of the above states can a process be directly moved into the blocked state?

2013 A/L

1.
 - a. What is a relationship between a program and a process in an operating system?
 - b. What is the need of having “swapped out and waiting” and “swapped out and blocked” states in the seven state process model of an operating system?

2014 A/L

1.
 - a. Consider the following statement regarding Operating Systems:
“Process is another name for a program”
Do you agree with this statement? (Yes/no) Give a reason.
 - b. Consider the following process state transition diagram in an operating system:



Fill in the blanks in the table given below by providing most suitable terms for the labels A, B, C and D.

Label	Term
A	
B	
C	
D	

2015 A/L

1. An operating system uses seven state process transition model for process scheduling. A given process is currently in the running state of the above model. Fill the following table with the correct next possible state and condition for transitions.

Current state	Next possible state	Condition for transition
Running		

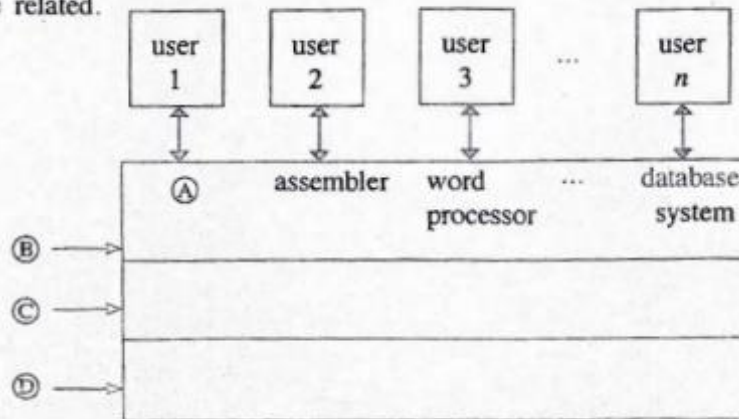
2017 A/L

1.
 - a. In an Operating System, what are the events that change the state of a process in the “running” state?
 - b. Explain the main actions performed by an Operating System during context switching.
 - c. Explain what will happen during the booting process of a computer.

2018 A/L

1.

(a) Consider the following diagram which shows how the abstract layers of a computer system are related.



Choose and write down the correct terms from the list given below for labels (A), (B), (C) and (D).

List = {compiler, computer hardware, live-ware, operating system, system /application programs}

- (A)
(B)
(C)
(D)

(b) Order **four** of the following statements in the correct sequence to describe the operations that take place when a computer is switched on.

(Note: Two of the statements will **not** be needed.)

- A - The BIOS copies Operating System (OS) files into memory and the OS starts executing.
- B - The BIOS looks to the CMOS chip to tell it where to find the OS.
- C - The compiler is started.
- D - The contents in memory is swapped to the hard disk.
- E - The OS loads the device drivers that it needs to control the devices and gives a login interface to the user.
- F - Triggered by a series of clock ticks, the CPU executes the startup program's instructions in the BIOS that involves the power on self-test.

The sequence of operations is: (fill in the boxes with relevant letters)



- (c) The state transitions that could occur in a process running on a computer with a multi-tasking operating system is shown in the following diagram:



- (i) Choose and write down the transition triggers indicated by the labels A, B, C and D from the list given.

List = {interrupt, Input/Output (I/O) or event completion, I/O or event wait, scheduler dispatch}

- A B
C D

- (ii) For the process above, give one possible reason for the following transition trigger:

interrupt:

- (d) In a certain computer, the physical memory has a total capacity of 4GB. The size of a memory frame is 4 KB.

- (i) Compute the total number of frames in the physical memory.

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- (ii) The operating system maintains a data structure named the *page table* in respect of each process running in the computer. For what purpose is it used?

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- (iii) With respect to the physical memory size, what is the benefit of using the technique of virtual memory in the above computer?

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1.

- (a) An operating system uses *Process Control Blocks (PCBs)* to maintain important information about each process.

Read the following scenario and answer the given questions:

Rani starts a computational application on a single processor computer. While the relevant computations are in progress, she starts a web browser application as well, in order to search for some information.

Write down the content that will be stored in the following PCB fields of the **computing process** when the "*computing process* → *web browser process*" context switch is made.

- (i) Program counter

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- (ii) Process state (*Ready, Running or Blocked?*)

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- (b) (i) What is meant by *contiguous file space allocation*?

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- (ii) Write down **one** drawback of *contiguous file space allocation*.

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- (iii) However, contiguous allocation is feasible to store a set of files on a CD ROM. Why?

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- (iv) In addition to the normal data items, write down **one** other information that will exist in a file block in the *linked file space allocation scheme*.
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- (c) Assume that a 32 KB program is run on a computer having 32 KB of physical memory. The page size of the system is 4 KB. The page table of this process at a particular time is shown on the table below.

Notes:

- Only a few selected fields of each page table entry is shown.
- The *frame number* is indicated in binary.
- The virtual addresses on page 0 are from 0 to 4095 and on page 1 are from 4096 to 8191 and so on.
- The *Present/absent* bit indicates the validity of the entry. If this bit is 1, the entry is valid and can be used. If it is 0, then the relevant virtual page is not in physical memory.

Page number	Frame number	Present / absent
0	110	1
1	001	1
2	010	1
3	100	1
4	011	1
5	000	0
6	000	0
7	101	1

- (i) Assume this program requires accessing virtual address 8200. To which physical address will it get transformed to?
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- (ii) Write down **one** advantage that the use of page tables bring with respect to program sizes compared to the size of physical memory.
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- (iii) Give **one** reason as to why a particular page of a process could be absent in physical memory.
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2020 A/L

1.

4. (a) An operating system uses *Process Control Blocks (PCBs)* to maintain important information about each process.

(i) Read the following scenario and answer the given question:

Piyal starts a spreadsheet program on a single processor computer to use the budget.xls file that he saved the day before. He also is running a web browser that he uses to check his email.

At a particular time, the operating system changes the **process state** field in the PCB of the **spreadsheet process** from "Running" to "Blocked". Give **one** likely reason for that transition.

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(ii) When the state of a process changes (e.g., "Running" → "Ready"), the values of the machine registers are stored in the PCB of that process. Why is it important to store them?

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- (b) The block size of a disk is 4 KB. A portion of its **File Allocation Table (FAT)** starting from block 300 at a particular time, is shown below. It gives the blocks of *maximum.py* file as well:

FAT

300	303
301	300
302	
303	304
304	-1

Note: The last block of a file is indicated by -1.

(i) Write down the value of an important number that will be stored in the **directory entry** for *maximum.py* file that will help an operating system locate the blocks in that file.

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(ii) Assume that additional improvements are made to the *maximum.py* file that results in its size becoming 20 KB. What changes are needed in the FAT for this purpose?

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- (c) Assume that we have a computer that can use 16-bit virtual addresses from 0 up to 64 K.

Assume further that this computer has only 32 KB of physical memory and that the page size in this computer is 4 KB.

(i) The above 16-bit virtual address is made up of the *bits of the page number* followed by *offset bits*. How many bits in the address are required to store a page number in this computer?

- (ii) User runs a particular program having a size of 32KB on this computer. A few selected fields of the *page table* of that process at a particular time are shown in the figure below.

Page number	Frame number	Present/absent
0	101	1
1	000	0
2	000	0
3	110	1
4	011	1
5	000	0
6	111	1
7	000	0

Notes:

- The frame number is indicated in *binary*.
- The virtual addresses on page 0 are from 0 to 4095 and on page 1 are from 4096 to 8191 and so on.
- The **Present/absent** bit indicates the validity of the entry. If this bit is 1, the entry is valid and can be used. If it is 0, then the relevant virtual page is not in physical memory.

Assume that in the above process the virtual address 0011 0000 0000 0010 is wanted.

The above virtual address is mapped to the physical address 110 0000 0000 0010. Explain it.

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- (iii) Assume that there was a request for the virtual address 0001 0000 0000 0000. Due to the set of tasks that the operating system initiated to fulfil that request, the present/absent bit of the page number 6 in the above page table changed from 1 to 0. What is the likely 15-bit physical address that the virtual address 0001 0000 0000 0000 will be mapped to?

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- (i) A student asks you how all applications started by him execute simultaneously although he has a **single-processor computer**. Write down your explanation. **[03 marks]**
- (ii) Programs whose sizes are even larger than the size of the available physical memory of a computer could be executed on it. How can that be possible? **[04 marks]**
- (iii) When *linked allocation* is used for disk space allocation, each file needs slightly more storage space than when *contiguous allocation* is used. Explain the reason for it. **[02 marks]**