ACTIVITY 16F

1 Identify, in order, the four stages of compilation.
Describe what happens to a program at each stage of compilation.

2 a) Draw syntax diagrams to represent a variable that must start with a letter (I, J or K) that is followed by up to three digits (0, 1, 2, 3, 4).

b) Represent the same variable in BNF.

c) These variables can be used in an assignment statement for addition or subtraction. Represent the assignment statement by a syntax diagram and in BNF.

3 a) Convert the following expressions to RPN.

i) A + B + C * D

ii) (A + B + C) * D

iii) (A + B) * D + (A – B) * C

b) Show how each of the above expressions, when converted to RPN, can be evaluated using a stack.
A = 7, B = 3, C = 5 and D = 2.

End of chapter questions

1 This table shows the burst time and arrival time for four processes:

Process	Burst time (ms)	Arrival time (ms)
P1	18	0
P2	4	1
P3	8	2
P4	3	3

This is a list of average waiting times, in ms:

6.0 6.25 6.5 8.0 8.25 10.0 11.25 14.0 14.25 14.5

Choosing from the list, select the correct average waiting time for the four processes, P1–P4, for each of these scheduling routines:

a) FCFS

[2]

b) SJF

[2]

c) SRTF

[2]

d) Round robin

[2]

2 A computer operating system (OS) uses paging for memory management.

In paging:

– main memory is divided into equal-size blocks, called page frames
– each process that is executed is divided into blocks of same size, called pages
– each process has a page table that is used to manage the pages of this process

The following table is the incomplete page table for a process, Y.

Page	Presence flag	Page frame address	Additional data
1	1	221	
2	1	222	
3	0	0	
4	0	0	
5	1	542	
6	0	0	
∫	∫	∫	∫
249	0	0	

a) State **two** facts about Page **5**.

[2]

b) Process Y executes the last instruction in Page **5**. This instruction is not a branch instruction.

i) Explain the problem that now arises in the continued execution of process Y.

[2]

ii) Explain how interrupts help to solve the problem that you explained in part b) i).

[3]

c) When the next instruction is not present in main memory, the OS must load its page into a page frame.
If all page frames are currently in use, the OS overwrites the contents of a page frame with the required page.
The page that is to be replaced is determined by a page replacement algorithm.
One possible algorithm is to replace the page which has been in memory the shortest amount of time.

i) Give the additional data that would need to be stored in the page table.

[1]

ii) Copy and complete the table entry below to show what happens when Page **6** is swapped into main memory.
Include the data you have identified in part c) i) in the final column.
Assume that Page **1** is the one to be replaced.
In the final column, give an example of the data you have identified in part c) i).

[3]

Page	Presence flag	Page frame address	Additional data
∫	∫	∫	∫
6			
∫	∫	∫	∫

Process Y contains instructions that result in the execution of a loop, a very large number of times. All instructions within the loop are in Page **1**.

The loop contains a call to a procedure whose instructions are all in Page **3**.

All page frames are currently in use.

Page **1** is the page that has been in memory for the shortest time.

iii) Explain what happens to Page **1** and Page **3**, each time the loop is executed.

[3]

iv) Name the condition described in part c) iii).

[1]

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3 State the ten computer terms being described below.

a) A fixed time slice allotted to a process.

[1]

b) When a process switches from running state to steady state or from waiting state to steady state.

[1]

c) System which gives the illusion that there is unlimited memory available.

[1]

d) Algorithm which decides which process (in the ready state) should get CPU time next (running state).

[1]

e) Procedure by which, when the next process takes control of the CPU, its previous state is restored.

[1]

f) Physical memory and logical memory are split up into fixed-size memory blocks.

[1]

g) When a process terminates or switches from running state to waiting state.

[1]

h) Time when a process gets control of the CPU.

[1]

i) Logical memory is split up into variable-size memory blocks.

[1]

j) To continuously deprive a process of the necessary resources to process a task.

[1]

4 A number of processes are being executed in a computer. A process can be in one of these states: running, ready or blocked.

a) For each of the following, the process is moved from the first state to the second state. Describe the conditions that cause each of the following changes of state of a process:

i) From blocked to ready.

[2]

ii) From running to ready.

[2]

b) Explain why a process cannot move directly from the ready state to the blocked state.

[3]

c) A process in the running state can change its state to something which is neither the ready state nor the blocked state.

i) Name this state.

[1]

ii) Identify when a process would enter this state.

[1]

d) Explain the role of the low-level scheduler in a multiprogramming operating system.

[2]

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5 **a)** Explain how programs can access data from memory when using virtual memory

[4]

b) Describe the following page replacement algorithms.

i) First in first out (FIFO)

[2]

ii) Optimal page replacement (OPR)

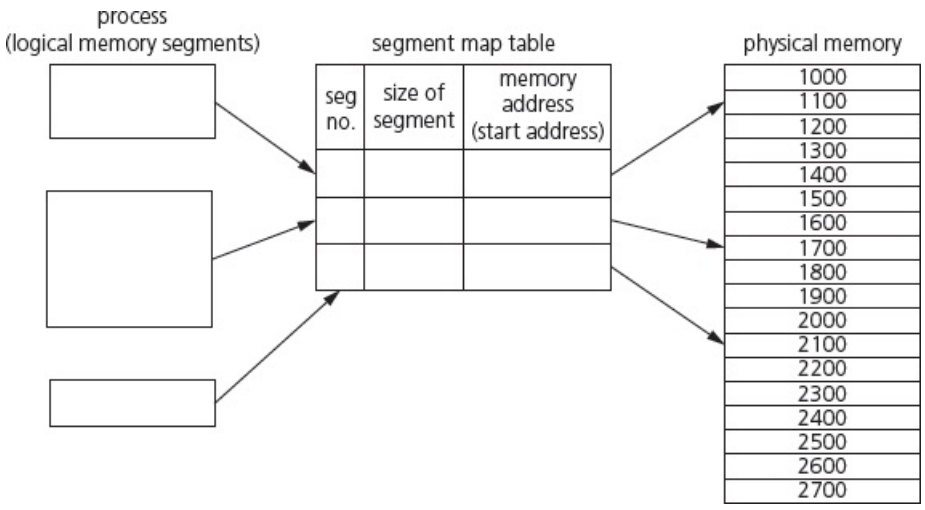
[2]

iii) Least recently used (LRU)

[2]

6 **a)** Three processes, A, B and C, are presently in logical memory.
Process A is 600 MiB, process B is 800 MiB and process C is 200 MiB.
The starting address in physical memory for process A is 1000.
Each of the units shown in physical memory are in MiB.
Copy and complete the following diagram to show how segmentation can be used as a type of memory management.

[6]



b) Give **three** differences between paging and segmentation.

[3]

c) Name three types of interrupt.

[3]

7 In this question, you are shown pseudocode in place of a real high-level language. A compiler uses a keyword table and a symbol table.
Part of the keyword table is shown below.

– Tokens for keywords are shown in hexadecimal.

Keyword	Token
←	01
+	02
=	03

– All the keyword tokens are in the range 00 to 5F.

IF	4A
THEN	4B
ENDIF	4C
ELSE	4D
FOR	4E
STEP	4F
TO	50
INPUT	51
OUTPUT	52