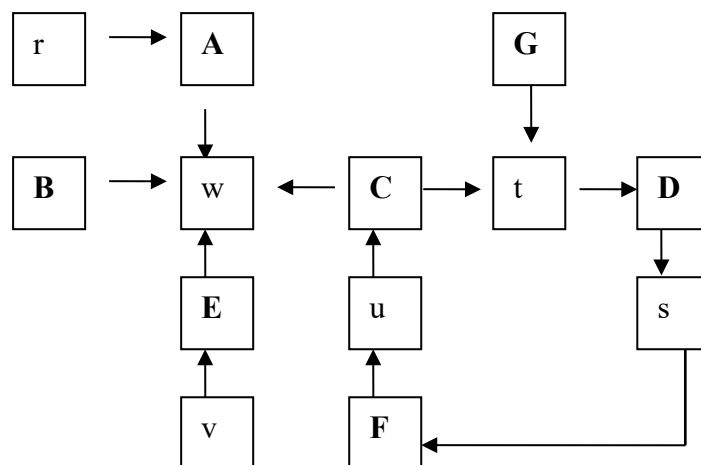


## 7SENG012W Operating Systems Tutorial questions - Solutions

1. Resource allocation in a computer system has produced the following:

- Process A holds resource r and wants w
- Process B holds nothing and wants w
- process C holds resource u and wants w and t
- process D holds resource t and wants s
- process E holds resource v and wants w
- Process F holds resource s and wants u
- Process G holds nothing and wants t

Show with the help of a diagram whether the system is deadlocked, and if so, which processes are involved and whether any of the processes can complete?



C, D and F are in dead lock --- cycle; A, E and B are in competition and can complete

G is also in deadlock as it wants resource t but D is in deadlock

2. Assume that a computer system is equipped with 1024K memory starting at address 0. The memory is organised using the Buddy system. Initially all memory is free. Allocations and deallocations are received as follows:

Request A: 65K		FIRST
Request B: 50K		
Request C: 70K		
Return B		
Request D: 120K		
Return C		
Return A		LAST
Return D		

Show diagrammatically each of the steps including how allocations and deallocations are carried out as well as the merger of blocks of memory.

1024K					
512K				512k	
256K			256K		512k
128K	128K		256K		512k
PA	128K		256K		512k
PA	64K	64K	256K		512k
PA	PB	64K	256K		512k
PA	PB	64K	128K	128K	512k
PA	PB	64K	PC	128K	512k
PA	64K	64K	PC	128K	512k
PA	128K		PC	128K	512k
PA	PD		PC	128K	512k
PA	PD		128K	128K	512k
PA	PD		256K		512K
128K	PD		256K		512K
128K	128K		256K		512K
256K			256K		512K
512K				512K	
1024K					

3. A virtual memory has a page size of 2048 Bytes, six virtual pages and five physical page frames.

The page table is as follows:

Virtual Page	Page Frame
0	3
1	Not in Memory
2	0
3	1
4	2
5	4

Generate a table showing the virtual addresses of each of the pages and the physical addresses of the existing page frames

Virtual Page	Addesses	Page Frame	Addesses
0	0000 - 2047	3	6144 – 8191
1	2048 - 4095	Not in Memory	Page Fault
2	4096 - 6143	0	0000 - 2047
3	6144 – 8191	1	2048 - 4095
4	8192 – 10239	2	4096 - 6143
5	10240 - 12287	4	8192 – 10239

Calculate the physical addresses for those of the following virtual addresses:

- 1920
- 2730
- 655
- 9120

VA	Physical address
1920	$1920 - 0 + 6144 \Rightarrow 8064$
2730	Page Fault
655	$655 - 0 + 6144 \Rightarrow 6799$
9120	$9120 - 8192 + 4096 \Rightarrow 5024$


4. Given a computer system using a linked list memory management scheme, with the following free list:

Element	Size
Element 1	100K
Element 2	100K
Element 3	270K
Element 4	300K
Element 5	200K
Element 6	350K

Using suitable tables, show how memory is allocated for each of the following memory management schemes:

- First fit
- Next fit
- Best fit
- Worst fit

In your answer, assume that the following four requests arrive in the order specified below:

Process 1	250K		FIRST
Process 2	50K		
Process 3	90K		
Process 4	80K		
Process 5	270K		LAST

First Fit	100K	100K	270K	300K	200K	350K
P1 250K	100K	100K	<b>20K</b>	300K	200K	350K
P2 50K	<b>50K</b>	100K	20K	300K	200K	350K
P3 90K	50K	<b>10K</b>	20K	300K	200K	350K
P4 80K	50K	10K	20K	<b>220K</b>	200K	350K
P5 270K	50K	10K	20K	220K	200K	<b>80K</b>

Next Fit	100K	100K	270K	300K	200K	350K
P1 250K	100K	100K	<b>20K</b>	300K	200K	350K
P2 50K	100K	100K	20K	<b>250K</b>	200K	350K
P3 90K	100K	100K	20K	<b>160K</b>	200K	350K
P4 80K	100K	100K	20K	<b>80K</b>	200K	350K
P5 270K	100K	100K	20K	80K	200K	<b>80K</b>

Best Fit	100K	100K	270K	300K	200K	350K
P1 250K	100K	100K	<b>20K</b>	300K	200K	350K
P2 50K	<b>50K</b>	100K	20K	300K	200K	350K
P3 90K	50K	<b>10K</b>	20K	300K	200K	350K
P4 80K	50K	10K	20K	300K	<b>120K</b>	350K
P5 270K	50K	10K	20K	<b>30K</b>	120K	350K

Worst Fit	100K	100K	270K	300K	200K	350K
P1 250K	100K	100K	270K	300K	200K	<b>100K</b>
P2 50K	100K	100K	270K	<b>250K</b>	200K	100K
P3 90K	100K	100K	<b>180K</b>	250K	200K	100K
P4 80K	100K	100K	180K	<b>170K</b>	200K	100K
P5 270K	Garbage Collection or Compaction					

