COMP30640 Operating Systems: Quiz 9

Exercise 4
Distinguish between internal and external fragmentation.

Sample Solution 4
Fragmentation occurs when memory is allocated and returned to the system. As this occurs, free memory is broken up into small chunks, often too small to be useful. External fragmentation occurs when there is sufficient total free memory to satisfy a memory request, yet the memory is not contiguous, so it cannot be assigned. Some contiguous allocation schemes may assign a process more memory than it actually requested (i.e. they may assign memory in fixed-block sizes). Internal fragmentation occurs when a process is assigned more memory than it has requested and the wasted memory fragment is internal to a process.

Exercise 5
Explain the sequence of events that happens when a page-fault occurs.

Exercise 5 – Solution
When the operating system cannot load the desired page into memory, a page-fault occurs. First, the memory reference is checked for validity. In the case of an invalid request, the program will be terminated. If the request was valid, a free frame is located. A disk operation is then scheduled to read the page into the frame just found, update the page table, restart the instruction that was interrupted because of the page-fault, and use the page accordingly.

Exercise 6,7,8 Page replacement algorithms
A system receives a series of page references in the following order:

A B C D E F C A A F F G A B G D F F

The memory system has four frames, all initially empty. Indicate how many page faults happen using each of the following algorithms:

1. FIFO
2. MIN
3. LRU

Include the page faults required to fill up the initially empty frames, and give a sequential diagram of the content of the memory frames.

Sample Solution 6, 7, 8

Access		A	B	C	D	E	F	C	A	A	F	F	G	A	B	G	D	F	F
FIFO 11 Page Faults	1	A				E									B				
	2		B				F										D		
	3			C					A									F	
	4				D								G						
MIN 8 Page Faults	1	A															D		
	2		B														D		
	3			C									G				D		
	4				D	E	F												
LRU 11 Page Faults	1	A				E							G						
	2		B				F										D		
	3			C											B				
	4				D				A									F	