Assignment 7 solutions

Question 1:

a. Size: In paging, the size of a page is fixed whereas in segmentation, the program is divided into variable sized sections.
b. Fragmentation: Paging can lead to internal fragmentation whereas segmentation risks external fragmentation.
c. Logical addresses: In paging, the logical address is formed by concatenating the page number bits (most significant bits) and the page offset bits (least significant bits), e.g. If the logical address is formed of N bits and the pages are of size 2^k, then the page number will be the upper (N-K) bits of the N-bits address and the page offset will be the lower k bits of the address. In segmentation however, logical addresses are specified as a 2-tuple, (segment number, segment offset).

Question 2:

Paging is implemented by breaking up an address into a page and offset number. It is most efficient to break the address into X page bits and Y offset bits, rather than perform arithmetic on the address to calculate the page number and offset.
Because each bit position represents a power of 2, splitting an address between bits results in a page size that is a power of 2.

Question 3:

Page number: log 512 = 9 bits
Page offset: log 128 = 7 bits
Address bits: 9 + 7 = 16 bits

To represent all pages we need 9 bits and within each page of 7 bits to address each bit and hence the total = 9+7 = 16

Refer to CS6233_Lect_8_20201104.pdf (Slide 34 onwards) for more clarity.

Question 4:

Page size 1KB = 2 ^ 10 bits , 10 bits page offset
Address 74373 = 0x00012285 = 00000000 00000001 00100010 10000101 Therefore, Page number bits are represented by total bits - page offset bits i.e. the most significant 22 bits of the 32-bit representation (32 bits total - 10bits page offset).
Hence, the page number is 72.

Refer to CS6233_Lect_8_20201104.pdf (Slide 34 onwards) for more clarity.

Question 5:

2MB / 8KB = 2 ^ 8 entries = 256 entries

Question 6:

Yes, the fifo algorithm does exhibit belady's anomaly. It may be noted that the code sometimes needs to be run multiple times to come across an instance when belady's anomaly is exhibited.