Prepare your answers to the following questions either in a plain text file or in a Microsoft Word file. Answer each question clearly and concisely, and state conclusions using complete sentences. Explanatory tables and/or diagrams are acceptable, but there must always be a written discussion as well.

Submit your file to the Curator system by the posted deadline for this assignment. No late submissions will be accepted.

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1. [5 points] A system uses a fixed-partition scheme, with equal-sized partitions of 2^{16} bytes, and a total main memory size of 2^{24} bytes. A process table is maintained that includes a pointer to the resident partition for each resident process. How many bits are required for this pointer? Why?

   The number of partitions would be $2^{24}/2^{16}$, or 2^8. So, the pointer to the partition would require 8 bits.

2. [12 points] A system uses a dynamic partitioning scheme, and the current memory configuration is as shown below.

   The shaded areas are allocated blocks. The unshaded areas are free blocks. The next three memory requests are for 40MB, 20MB, and 60MB. Indicate the starting address for each of the three blocks using the specified placement algorithm:

   a) first-fit

40MB	20MB	60MB
80M	20M	n/a

   b) best-fit

40MB	20MB	60MB
230M	20M	80M

   c) next-fit (assuming the most recently added previous block is the right-most allocated block)

40MB	20MB	60MB
80M	120M	n/a

   d) worst-fit

40MB	20MB	60MB
80M	230M	n/a

3. [15 points] A system uses simple paging, with 2^{32} bytes of main memory, a page size of 2^{10} bytes, and 2^{16} pages of logical (virtual) memory.

   a) How many bits are in a logical (virtual) address?

   Virtual memory consists of 2^{16} pages, each holding 2^{10} bytes, for a total of 2^{26} bytes. So, virtual addresses would require 26 bits.

   b) How many bytes are in a frame?

   The size of a frame is always the same as the size of a virtual page, so 2^{10} bytes.

   c) How many bits in the physical address specify the frame?

   There are $2^{32}/2^{10} = 2^{22}$ frames in physical memory, so it takes 22 bits to specify the frame.

4. [8 points] A virtual address *a* in a paging system is equivalent to a pair (*p*, *w*), where *p* is a page number and *w* is an offset within the page. Let *z* be the number of bytes in a page. Find algebraic formulas that show *p* and *w* as functions of *a* and *z*.

   p = a / z (integer division)
   w = a % z (mod)