

**HW 4-3600 Operating System**

**Submit your answers in Canvas as a pdf document on or before (04/18/2021).**

**Answer all 4 questions – 10 points each**

1. Memory contains 6 holes with the sizes: 190, 550, 220, 420, 650, and 110.  
A sequence of requests for 4 block is to be satisfied: A = 210, B = 430, C = 100, and D = 420. Determine which holes are allocated to which request by each of the 4 allocation schemes and compare the results.
  
2. The 50% rule refers only to the number of holes and blocks, but not the amounts of memory space taken up by the holes and blocks. The amounts of space depend on the average hole size vs the average block size.  
If  $k$  is the ratio between average hole size and average block size, then the fraction  $f$  of space occupied by holes can be determined using the formula  $f = k/(k + 2)$ .
  - a. Determine the fraction of space wasted in holes if, on average, an occupied block is twice as large as a hole. (write the equation only.)
  - b. Determine the fraction of space wasted in holes if, on average, a hole is twice as large as an occupied block.

3. Paging systems A through D use different combinations of pages sizes and address sizes:

	A	B	C	D
Page size (# of words)	512	1024	512	1024
Logical address size (# of bits)	16	16	32	32

For each system determine:

- a. The page table size (Number of pages).
  - b. The size of the logical address space (Number of words).
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4. Three functions, each of length 600 words, are linked together into one process and loaded into memory. Consider four possible combinations of paging and segmentation:
    - i. Paging (no segmentation):  
page size: 1024 words  
page table occupies 1 page
    - ii. Segmentation (no paging):  
segment table size: 1024 words
    - iii. Segmentation with paging (each function becomes a separate segment):  
page and segment size: 1024  
page and segment tables occupy 1 page each
    - iv. Two-level paging (page table is paged):  
page size: 1024  
all page tables occupy 1 page each

- a. For each system, determine the total amount of occupied memory space, including all page or segment tables.
- b. For each system, determine the amount of space wasted due to internal fragmentation.

**What to turn in Canvas:**

Answers in a pdf document.