CS3600

Worksheet 07- Solution

1. Memory contains 6 holes with their sizes shown in the table.

Hole	A	B	C	D	E	F
Size	140	70	90	120	60	40

A sequence of requests for 3 blocks have arrived with sizes 10, 50, and 80. Select the hole allocated to each request by the first-fit allocation strategy.

Which holes will be allocated for each block?

A, A, A

2. Memory contains 6 holes with their sizes shown in the table.

Hole	A	B	C	D	E	F
Size	80	90	10	100	40	60

A sequence of requests for 3 blocks have arrived with sizes 70, 50, and 20. Select the hole allocated to each request by the next-fit allocation strategy.

Which holes will be allocated for each block?

A, B, D

3. Memory contains 6 holes with their sizes shown in the table.

Hole	A	B	C	D	E	F
Size	20	140	70	120	110	60

A sequence of requests for 3 blocks have arrived with sizes 50, 40, and 30. Select the hole allocated to each request by the best-fit allocation strategy.

Which holes will be allocated for each block?

F, C, C

4. Memory contains 3 holes of 10 MB each. A sequence of 14 requests for 1 MB each is to be processed. For each of the four memory allocation strategies, determine the sizes of the remaining holes after all 14 requests have been satisfied.

Strategy	Remaining hole sizes	Comments
First-fit	6, 10	First-fit starts with the 1st hole and continues until 10 requests are satisfied. Then first-fit places the remaining 4 blocks into the 2nd hole. The 3rd hole remains empty.

Next-fit	5, 5, 6	Next-fit places the 1st block into the 1st hole, the second block into the 2nd hole, and the 3rd block into the 3rd hole. Next-fit then places the 4th request into the 1st hole and continues in the round-robin fashion until all 14 requests are satisfied.
Best-fit	6, 10	Best-fit places the 1st request into the 1st hole, which now becomes the smallest hole. Thus best-fit continues placing blocks into the 1st hole until the hole is full, then continues with the 2nd hole in the same way.
Worst-fit	5, 5, 6	Worst-fit also starts with the 1st hole. Since the 1st hole is no longer the largest, the 2nd block is placed into the 2nd hole, and so on. Thus worst-fit behaves in the same way as next-fit.

5. Memory size is 18 MB. Hole size = block size = 1 KB. The 50% rule holds. (I MB =1000 KB)

(a)Determine the total number of holes.

The total number of holes and occupied blocks is 18 MB / 1 KB = 18,000. The 50% rule states that 1/3 of all blocks are holes. Thus the number of holes is 18,000/3 = 6,000.

(b) Determine the total number of occupied blocks.

The number of occupied blocks is twice the number of holes: 2 * 6,000 = 12,000.

(c) Determine the amount of space occupied by holes in MB.

Holes occupy 1/3 of total memory: 18 MB / 3 = 6 MB.

6. 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.

      The ratio k is 1/2 and thus $k = 0.5/(2 + 0.5) = 0.2$ Thus 20% of memory is wasted on holes.

   b. Determine the fraction of space wasted in holes if, on average, a hole is twice as large as an occupied block.

      The ratio k is $2/1 = 2$ and thus $k = 2/(2 + 2) = 0.5$. Thus 50% of memory is wasted on holes.