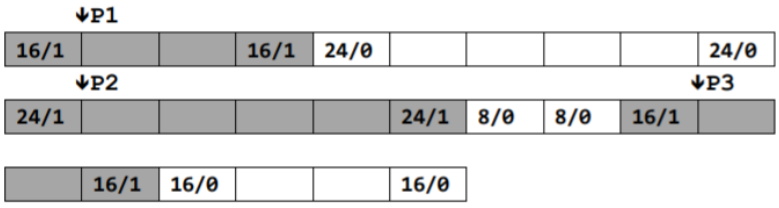
ICS EXE 11

May 26, 2021

1 Memory Allocation

Now we organize the heap as a sequence of **contiguous** allocated and free blocks, as shown below. **Allocated** blocks are shaded, and **free** blocks are blank (each block represents 1 word = 4 bytes). **Headers** and **footers** are labeled with the number of bytes and allocated bit. The allocator maintains **double-word** alignment. You are given the execution sequence of memory allocation operations (`malloc()` or `free()`) from 1 to 6.




```
1. P4 = malloc(8)
2. free(P1)
3. P5 = malloc(6)
4. free(P2)
5. P6 = malloc(3)
6. P7 = malloc(2)
```

Please answer the questions below. Assume that **immediate coalescing** strategy and **splitting free blocks** are employed. (NOTE: **DON'T** need consider P1, P2 and P3 when calculating **internal** fragments)

1. Assume **best-fit** algorithm is used to find free blocks. Please draw the **final** status of memory and mark with block size in headers and footers after the operation sequence is executed. Please also calculate the total bytes of the **internal** fragments.

2. Assume **first-fit** algorithm is used to find free blocks. Please draw the **final** status of memory and mark with block size in headers and footers after the operation sequence is executed. Please also calculate the total bytes of the **internal** fragments.

3. Suppose that we use the entire free block instead of splitting when doing allocation and coalesce immediately after freeing. The total size of heap we can use is shown in the picture. Please identify that whether the operation sequence will succeed or not for both **first-fit** and **best-fit** respectively. If yes, please give the total bytes of the **internal** fragments. fragments. If no, please point out **which step** causes the failure (out of memory).

2 Thread and Process

1. Starvation (in relation to threads) refers to:

(A) A thread waiting for a lock indefinitely.

(B) A semaphore that gets locked but the thread never unlocks it after use.

(C) A thread is spawned but never joins the main thread when finished.

(D) A process fails to spawn a new thread because it's hit the maximum number of threads allowed.

2. Each thread has its own:

(A) Heap

(B) Stack

(C) Global values

(D) Text data

3. Which one of the following statements about processes is false?

(A) The operating system kernel runs as its own separate process.

(B) Each process shares the CPU with other processes.

(C) Each process has its own private address space.

(D) The environment for a process is stored on the stack.