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EECS 338 Assignment 6  
Response Answers

1. The main challenges of a parallel memory allocator are:
  1. Dealing with fragmentation, which can develop over time after many allocations and deallocations.
  2. Allowing parallel processes to use the same heap without deadlocks or starvation.
2. My allocator chooses the next free block via a First-Fit algorithm, as follows:

```
linked_list list; //list of currently allocated blocks
allocate( amount)
    for each block in list:
        if the space preceding the current block fits amount
            add a block of size amount before the current block,
            starting at the beginning of the free space

    if no blocks in list and amount < total arena length:
        make the head of list = a new block of size amount
```

The advantage of First-Fit is that allocations happen very quickly, because the algorithm never has to make more than one pass through the arena, and most of the time halts early once it finds a suitable spot.

The disadvantage of First-Fit is that it is naive, and can sometimes result in suboptimal allocations, such as a very small allocation into a large block when there are smaller free blocks that happen to be further down the heap.

3. To keep track of free blocks, I kept a linked list of the start and end offsets of allocated blocks, and considered free blocks to be the "negative space" between them. This allowed me to free memory easily without worrying about coalescing.

An alternative is to keep a linked list of the start and end offsets of the *unallocated* blocks, but this would have made freeing memory difficult when the deallocate command is given with an offset that lies in the middle of an allocated block.