

## Task 1 report:

I calculated memory leaks by maintaining two variables, `space_allocated` and `space_freed`. For every `malloc()` that was called, I added the size of the `malloc` to the `space_allocated` variable. Similarly, for each `free()` that was called, I added the size of the block that was freed to the `space_freed` variable. At the end, I calculated how much memory was leaked by subtracting `space_freed` from `space_allocated`, as memory leaks are defined as memory that was allocated but not freed.

## Memory Leak for 10 mallocs and 10 frees:

```
@ashjianda → /workspaces/MemoryManagement (main) $ ./q1 10 10
Completed malloc 1, start address = 0x5f9b84111000, end address = 0x5f9b8411101c
Completed malloc 2, start address = 0x5f9b84111434, end address = 0x5f9b84111450
Completed malloc 3, start address = 0x5f9b84111450, end address = 0x5f9b8411146c
Completed malloc 4, start address = 0x5f9b8411146c, end address = 0x5f9b84111488
Completed malloc 5, start address = 0x5f9b84111488, end address = 0x5f9b841114a4
Completed malloc 6, start address = 0x5f9b841114a4, end address = 0x5f9b841114c0
Completed malloc 7, start address = 0x5f9b841114c0, end address = 0x5f9b841114dc
Completed malloc 8, start address = 0x5f9b841114dc, end address = 0x5f9b841114f8
Completed malloc 9, start address = 0x5f9b841114f8, end address = 0x5f9b84111514
Completed malloc 10, start address = 0x5f9b84111514, end address = 0x5f9b84111530
Completed free 1 at address 0x5f9b84111000
Completed free 2 at address 0x5f9b84111434
Completed free 3 at address 0x5f9b84111450
Completed free 4 at address 0x5f9b8411146c
Completed free 5 at address 0x5f9b84111488
Completed free 6 at address 0x5f9b841114a4
Completed free 7 at address 0x5f9b841114c0
Completed free 8 at address 0x5f9b841114dc
Completed free 9 at address 0x5f9b841114f8
Completed free 10 at address 0x5f9b84111514
Memory leak: 0 bytes
```

## Memory Leak for 15 mallocs and 15 frees:

```
@ashjianda → /workspaces/MemoryManagement (main) $ ./q1 15 15
Completed malloc 1, start address = 0x5ddcc51c8000, end address = 0x5ddcc51c801c
Completed malloc 2, start address = 0x5ddcc51c8434, end address = 0x5ddcc51c8450
Completed malloc 3, start address = 0x5ddcc51c8450, end address = 0x5ddcc51c846c
Completed malloc 4, start address = 0x5ddcc51c846c, end address = 0x5ddcc51c8488
Completed malloc 5, start address = 0x5ddcc51c8488, end address = 0x5ddcc51c84a4
Completed malloc 6, start address = 0x5ddcc51c84a4, end address = 0x5ddcc51c84c0
Completed malloc 7, start address = 0x5ddcc51c84c0, end address = 0x5ddcc51c84dc
Completed malloc 8, start address = 0x5ddcc51c84dc, end address = 0x5ddcc51c84f8
Completed malloc 9, start address = 0x5ddcc51c84f8, end address = 0x5ddcc51c8514
Completed malloc 10, start address = 0x5ddcc51c8514, end address = 0x5ddcc51c8530
Completed malloc 11, start address = 0x5ddcc51c8530, end address = 0x5ddcc51c854c
Completed malloc 12, start address = 0x5ddcc51c854c, end address = 0x5ddcc51c8568
Completed malloc 13, start address = 0x5ddcc51c8568, end address = 0x5ddcc51c8584
Completed malloc 14, start address = 0x5ddcc51c8584, end address = 0x5ddcc51c85a0
Completed malloc 15, start address = 0x5ddcc51c85a0, end address = 0x5ddcc51c85bc
Completed free 1 at address 0x5ddcc51c8000
Completed free 2 at address 0x5ddcc51c8434
Completed free 3 at address 0x5ddcc51c8450
Completed free 4 at address 0x5ddcc51c846c
Completed free 5 at address 0x5ddcc51c8488
Completed free 6 at address 0x5ddcc51c84a4
Completed free 7 at address 0x5ddcc51c84c0
Completed free 8 at address 0x5ddcc51c84dc
Completed free 9 at address 0x5ddcc51c84f8
Completed free 10 at address 0x5ddcc51c8514
Completed free 11 at address 0x5ddcc51c8530
Completed free 12 at address 0x5ddcc51c854c
Completed free 13 at address 0x5ddcc51c8568
Completed free 14 at address 0x5ddcc51c8584
Completed free 15 at address 0x5ddcc51c85a0
Memory leak: 0 bytes
```

Memory Leak for 15 mallocs and 10 frees:

```
@ashjianda →/workspaces/MemoryManagement (main) $ ./q1 15 10
Completed malloc 1, start address = 0x55cb5c622000, end address = 0x55cb5c62201c
Completed malloc 2, start address = 0x55cb5c622434, end address = 0x55cb5c622450
Completed malloc 3, start address = 0x55cb5c622450, end address = 0x55cb5c62246c
Completed malloc 4, start address = 0x55cb5c62246c, end address = 0x55cb5c622488
Completed malloc 5, start address = 0x55cb5c622488, end address = 0x55cb5c6224a4
Completed malloc 6, start address = 0x55cb5c6224a4, end address = 0x55cb5c6224c0
Completed malloc 7, start address = 0x55cb5c6224c0, end address = 0x55cb5c6224dc
Completed malloc 8, start address = 0x55cb5c6224dc, end address = 0x55cb5c6224f8
Completed malloc 9, start address = 0x55cb5c6224f8, end address = 0x55cb5c622514
Completed malloc 10, start address = 0x55cb5c622514, end address = 0x55cb5c622530
Completed malloc 11, start address = 0x55cb5c622530, end address = 0x55cb5c62254c
Completed malloc 12, start address = 0x55cb5c62254c, end address = 0x55cb5c622568
Completed malloc 13, start address = 0x55cb5c622568, end address = 0x55cb5c622584
Completed malloc 14, start address = 0x55cb5c622584, end address = 0x55cb5c6225a0
Completed malloc 15, start address = 0x55cb5c6225a0, end address = 0x55cb5c6225bc
Completed free 1 at address 0x55cb5c622000
Completed free 2 at address 0x55cb5c622434
Completed free 3 at address 0x55cb5c622450
Completed free 4 at address 0x55cb5c62246c
Completed free 5 at address 0x55cb5c622488
Completed free 6 at address 0x55cb5c6224a4
Completed free 7 at address 0x55cb5c6224c0
Completed free 8 at address 0x55cb5c6224dc
Completed free 9 at address 0x55cb5c6224f8
Completed free 10 at address 0x55cb5c622514
Memory leak: 20 bytes
```

Memory Leak for 20 mallocs and 10 frees:

```
@ashjianda →/workspaces/MemoryManagement (main) $ ./q1 20 10
Completed malloc 1, start address = 0x5f11099a7000, end address = 0x5f11099a701c
Completed malloc 2, start address = 0x5f11099a7434, end address = 0x5f11099a7450
Completed malloc 3, start address = 0x5f11099a7450, end address = 0x5f11099a746c
Completed malloc 4, start address = 0x5f11099a746c, end address = 0x5f11099a7488
Completed malloc 5, start address = 0x5f11099a7488, end address = 0x5f11099a74a4
Completed malloc 6, start address = 0x5f11099a74a4, end address = 0x5f11099a74c0
Completed malloc 7, start address = 0x5f11099a74c0, end address = 0x5f11099a74dc
Completed malloc 8, start address = 0x5f11099a74dc, end address = 0x5f11099a74f8
Completed malloc 9, start address = 0x5f11099a74f8, end address = 0x5f11099a7514
Completed malloc 10, start address = 0x5f11099a7514, end address = 0x5f11099a7530
Completed malloc 11, start address = 0x5f11099a7530, end address = 0x5f11099a754c
Completed malloc 12, start address = 0x5f11099a754c, end address = 0x5f11099a7568
Completed malloc 13, start address = 0x5f11099a7568, end address = 0x5f11099a7584
Completed malloc 14, start address = 0x5f11099a7584, end address = 0x5f11099a75a0
Completed malloc 15, start address = 0x5f11099a75a0, end address = 0x5f11099a75bc
Completed malloc 16, start address = 0x5f11099a75bc, end address = 0x5f11099a75d8
Completed malloc 17, start address = 0x5f11099a75d8, end address = 0x5f11099a75f4
Completed malloc 18, start address = 0x5f11099a75f4, end address = 0x5f11099a7610
Completed malloc 19, start address = 0x5f11099a7610, end address = 0x5f11099a762c
Completed malloc 20, start address = 0x5f11099a762c, end address = 0x5f11099a7648
Completed free 1 at address 0x5f11099a7000
Completed free 2 at address 0x5f11099a7434
Completed free 3 at address 0x5f11099a7450
Completed free 4 at address 0x5f11099a746c
Completed free 5 at address 0x5f11099a7488
Completed free 6 at address 0x5f11099a74a4
Completed free 7 at address 0x5f11099a74c0
Completed free 8 at address 0x5f11099a74dc
Completed free 9 at address 0x5f11099a74f8
Completed free 10 at address 0x5f11099a7514
Memory leak: 40 bytes
```