HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY, VNU HCM
FACULTY OF COMPUTER SCIENCE AND ENGINEERING

OPERATING SYSTEM:

Lab 8: Memory Allocation

Pham Minh Tuan - MSSV: 1752595

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1 Exercises

1.1 Questions:

1. Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of memory utilization.

   Answer:

   (a) First-Fit:
   - 115KB is put into 300KB partition, the memory remaining is (185KB, 600KB, 350KB, 200KB, 750KB, and 125KB)
   - 500KB is put into 600KB partition, the memory remaining is (185KB, 100KB, 350KB, 200KB, 750KB, and 125KB)
   - 358KB is put into 750KB partition, the memory remaining is (185KB, 100KB, 350KB, 200KB, 392KB, and 125KB)
   - 200KB is put into 350KB partition, the memory remaining is (185KB, 100KB, 150KB, 200KB, 392KB, and 125KB)
   - 375KB is put into 392KB partition, the memory remaining is (185KB, 100KB, 150KB, 200KB, 17KB, and 125KB)

   (b) Best-Fit:
   - 115KB is put into 125KB partition, the memory remaining is (300KB, 600KB, 350KB, 200KB, 750KB, and 10KB)
   - 500KB is put into 600KB partition, the memory remaining is (300KB, 100KB, 350KB, 200KB, 750KB, and 10KB)
   - 358KB is put into 750KB partition, the memory remaining is (300KB, 100KB, 350KB, 200KB, 392KB, and 10KB)
   - 200KB is put into 200KB partition, the memory remaining is (300KB, 100KB, 350KB, 0KB, 392KB, and 10KB)
   - 375KB is put into 392KB partition, the memory remaining is (300KB, 100KB, 350KB, 0KB, 17KB, and 10KB)

   (c) Worst-Fit:
   - 115KB is put into 750KB partition, the memory remaining is (300KB, 600KB, 350KB, 200KB, 635KB, and 125KB)
   - 500KB is put into 635KB partition, the memory remaining is (300KB, 600KB, 350KB, 200KB, 135KB, and 125KB)
   - 358KB is put into 600KB partition, the memory remaining is (300KB, 242KB, 350KB, 200KB, 135KB, and 125KB)
   - 200KB is put into 350KB partition, the memory remaining is (300KB, 242KB, 150KB, 200KB, 135KB, and 125KB)
   - 375KB must wait since the remaining parition cannot be used to allocate for this process.

(d) Rank the 3 algorithms:

- Of three algorithms used, the Best-Fit is the most efficient, then is the First-Fit and the last is Worst-Fit.
- Beside only the Worst-Fit algorithm is allowed to reject the request to be satisfied.
- Although the Best-Fit is the efficient algorithm, it take the time O(n) while the First-Fit is O(1).

2. Compare the advantages as well as disadvantages of these allocation algorithms: First-Fit, Best-Fit, Worst-Fit. Use specific examples to support your answer.

(a) First-Fit:

i. Advantage: Less time required for allocation and deallocation, this is the fastest one of 3 algorithms.

ii. Disadvantage: External fragmentation.

(b) Best-Fit:

i. Advantage: Better memory utilization, only search for the suitable smallest memory partition.

ii. Disadvantage: This is algorithm is the slowest one to compare with the other two algorithms.

(c) Worst-Fit:

i. Advantage: This algorithms works efficiently if the memory allocations are of the medium sizes partition.

ii. Disadvantage: External Fragmentation, waste memory blocks.

1.2 Programming Exercises:

This is what I gain so far for implement Best-Fit algorithm. Since the different between the Best-Fit and First-Fit algorithm is the blocks of memory it looks for, so I only change the way it look for the memory block in Best-Fit algorithm. The remaining in source code and the file main.c is the same after all.

```
Alloc [ 128 bytes] 0x7fffc23ae260-0x7fffc23ae2df
Free  [ 128 bytes] 0x7fffc23ae260-0x7fffc23ae2df
Alloc [ 128 bytes] 0x7fffc23ae260-0x7fffc23ae2df
Free  [ 128 bytes] 0x7fffc23ae260-0x7fffc23ae2df
Alloc [  32 bytes] 0x7fffc23ae260-0x7fffc23ae27f
Alloc [  32 bytes] 0x7fffc23ae280-0x7fffc23ae29f
Alloc [  16 bytes] 0x7fffc23ae2a0-0x7fffc23ae2af
Free  [  32 bytes] 0x7fffc23ae260-0x7fffc23ae27f
Alloc [ 128 bytes] 0x7fffc23ae2b0-0x7fffc23ae32f
Alloc [  16 bytes] 0x7fffc23ae330-0x7fffc23ae33f
Free  [  16 bytes] 0x7fffc23ae330-0x7fffc23ae33f
Alloc [  16 bytes] 0x7fffc23ae330-0x7fffc23ae33f
Alloc [  16 bytes] 0x7fffc23ae340-0x7fffc23ae34f
Free  [  16 bytes] 0x7fffc23ae330-0x7fffc23ae33f
Alloc [ 128 bytes] 0x7fffc23ae350-0x7fffc23ae3cf
```