

# Lab 6 Contiguous Memory Allocation Course: Operating Systems

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## 1 Exercise 1

process	first-fit	best-fit	worst-fit
115	300 (185kb hole left)	125 (10kb hole left)	750 (635kb hole left)
500	600 (100kb hole left)	600 (100kb hole left)	600 (100kb hole left)
358	750 (392kb hole left)	750 (392kb hole left)	X
200	350 (150kb hole left)	200 (150kb hole left)	350 (150kb hole left)
375	X	X	X
Total waste	1152	1302	1560

**Remark:**

**Ranking:** Best-fit > First-fit > Worst-fit

- **First-fit algorithm** : the remaining unused memory areas left after allocation become waste if it is too smaller to request allocation for other processes (115->300kb, 185kb hole -> much but not enough for others). Thus request for larger memory requirement cannot be accomplished. This leads to internal fragmentation
- **Best-fit algorithm**: much optimal than FF algorithm, avoid internal fragmentation, since it finds the smallest partition to fit with(ex. 115 -> 125kb, only 10kb hole left). However, it took  $O(n)$  time to search which is more than FF ( $O(1)$ ).
- **Worst-fit algorithm**: worse than 2 others since it caused memory waste by occupying all largest partitions which do not give slots for incoming processes. Moreover, it could cause internal fragmentation.

## 2 Exercise 2

**Solution:**

	first-fit	best-fit	worst-fit
Advantages	It is fast in allocation and short execution time, simple implementation	Memory Efficient, Save memory from getting wasted, avoid internal fragmentation	Large internal fragmentation -> quite big so that other small processes can also be placed in that leftover partition
Disadvantages	It wastes a lot of memory, causes internal fragmentation, ignoring optimal memory partition.	Slow process (searching operation) -> required appropriate searching algorithm	slow process (searching operation), memory inefficiency

### 3 Exercise 3

ARRAY\_SIZE = 5

**First-fit strategy:**

```
-----First-fit alloc-----
Free region: 1024|
Thread [ID = 1377]: NEED TO Alloc [ 64 bytes] : 0x55dcb36ab6b0-0x55dcb36ab6ef
Used region: 64|
Free region: 960|
Thread [ID = 1377]: NEED TO Alloc [ 16 bytes] : 0x55dcb36ab6f0-0x55dcb36ab6ff
Used region: 16| 64|
Free region: 944|
Thread [ID = 1377]: NEED TO Free [ 16 bytes] : 0x55dcb36ab6f0-0x55dcb36ab6ff
Used region: 64|
Free region: 960|
Thread [ID = 1377]: NEED TO Free [ 64 bytes] : 0x55dcb36ab6b0-0x55dcb36ab6ef
Used region:
Free region: 1024|
Thread [ID = 1378]: NEED TO Alloc [ 128 bytes] : 0x55dcb36ab6b0-0x55dcb36ab72f
Used region: 128|
Free region: 896|
Thread [ID = 1378]: NEED TO Alloc [ 64 bytes] : 0x55dcb36ab730-0x55dcb36ab76f
Used region: 64| 128|
Free region: 832|
Thread [ID = 1378]: NEED TO Free [ 64 bytes] : 0x55dcb36ab730-0x55dcb36ab76f
Used region: 128|
Free region: 896|
Thread [ID = 1378]: NEED TO Free [ 128 bytes] : 0x55dcb36ab6b0-0x55dcb36ab72f
Used region:
Free region: 1024|
Thread [ID = 1378]: NEED TO Alloc [ 128 bytes] : 0x55dcb36ab6b0-0x55dcb36ab72f
Used region: 128|
-----END-----
```

**Best-fit strategy:**

```
-----Best-fit alloc-----
Free region: 1024|
Thread [ID = 1380]: NEED TO Alloc [ 128 bytes] : 0x560d2fe6a6b0-0x560d2fe6a72f
Used region: 128|
-----
Free region: 896|
Thread [ID = 1380]: NEED TO Alloc [ 128 bytes] : 0x560d2fe6a730-0x560d2fe6a7af
Used region: 128| 128|
-----
Free region: 768|
Thread [ID = 1381]: NEED TO Alloc [ 64 bytes] : 0x560d2fe6a7b0-0x560d2fe6a7ef
Used region: 64| 128| 128|
-----
Free region: 704|
Thread [ID = 1381]: NEED TO Alloc [ 128 bytes] : 0x560d2fe6a7f0-0x560d2fe6a86f
Used region: 128| 64| 128| 128|
-----
Free region: 576|
Thread [ID = 1381]: NEED TO Free [ 64 bytes] : 0x560d2fe6a7b0-0x560d2fe6a7ef
Used region: 128| 128| 128|
-----
Free region: 64| 576|
Thread [ID = 1381]: NEED TO Alloc [ 32 bytes] : 0x560d2fe6a7b0-0x560d2fe6a7cf
Used region: 32| 128| 128| 128|
-----
Free region: 32| 576|
Thread [ID = 1381]: NEED TO Alloc [ 16 bytes] : 0x560d2fe6a7d0-0x560d2fe6a7df
Used region: 16| 32| 128| 128| 128|
-----
-----END-----
```

Worst-fit strategy:

```
-----Worst-fit alloc-----
Free region: 1024|
Thread [ID = 1383]: NEED TO Alloc [ 64 bytes] : 0x555afec516b0-0x555afec516ef
Used region: 64|
-----
Free region: 960|
Thread [ID = 1383]: NEED TO Free [ 64 bytes] : 0x555afec516b0-0x555afec516ef
Used region:
-----
Free region: 1024|
Thread [ID = 1383]: NEED TO Alloc [ 128 bytes] : 0x555afec516b0-0x555afec5172f
Used region: 128|
-----
Free region: 896|
Thread [ID = 1384]: NEED TO Alloc [ 16 bytes] : 0x555afec51730-0x555afec5173f
Used region: 16| 128|
-----
Free region: 880|
Thread [ID = 1384]: NEED TO Free [ 16 bytes] : 0x555afec51730-0x555afec5173f
Used region: 128|
-----
Free region: 896|
Thread [ID = 1384]: NEED TO Alloc [ 16 bytes] : 0x555afec51730-0x555afec5173f
Used region: 16| 128|
-----
Free region: 880|
Thread [ID = 1384]: NEED TO Free [ 16 bytes] : 0x555afec51730-0x555afec5173f
Used region: 128|
-----
-----END-----
```