

1.

First-fit

---200 MB is put in 205 MB hole, leaving
170MB, 100MB, 40MB, 5MB, 300MB, 185MB
---15 MB is put in 170 MB hole, leaving
155MB, 100MB, 40MB, 5MB, 300MB, 185MB
---185 MB is put in 300MB hole, leaving
155MB, 100MB, 40MB, 5MB, 115MB, 185MB
---75 MB is put in 155 MB hole, leaving
80MB, 100MB, 40MB, 5MB, 115MB, 185MB
---175 MB is put in 185 MB hole, leaving
80MB, 100MB, 40MB, 5MB, 115MB, 10MB
---90 MB is put in 100 MB hole, leaving
80MB, 10MB, 40MB, 5MB, 115MB, 185MB

SATISFIED

Best-fit

---200 MB is put in 205 MB hole, leaving
170MB, 100MB, 40MB, 5MB, 300MB, 185MB
---15 MB is put in 40 MB hole, leaving
170MB, 100MB, 25MB, 5MB, 300MB, 185MB
---185 MB is put in 185 MB hole, leaving
170MB, 100MB, 40MB, 5MB, 300MB, 0MB
---75 MB is put in 100 MB hole, leaving
170MB, 25MB, 40MB, 5MB, 300MB, 0MB
---175 MB is put in 300 MB hole, leaving
170MB, 25MB, 40MB, 5MB, 125MB, 0MB
---90 MB is put in 125 MB hole, leaving
170MB, 25MB, 40MB, 5MB, 35MB, 0MB

SATISFIED

Worst-fit

---200 MB is put in 300 MB hole, leaving
170MB, 100MB, 40MB, 205MB, 100MB, 185MB
---15 MB is put in 205 MB hole, leaving
170MB, 100MB, 40MB, 190MB, 100MB, 185MB
---185 MB is put in 190 MB hole, leaving
170MB, 100MB, 40MB, 5MB, 100MB, 185MB
---75 MB is put in 185 MB hole, leaving
170MB, 100MB, 40MB, 5MB, 100MB, 110MB
---175 MB couldn't put in any hole ($175 > 170$ or 100 or 40 or 5 or 100 or 110)

NOT SATISFIED

2.

- a) relocation of the entire program
- b) should increase the allocation of new pages

3. External fragmentation won't be a big problem for contiguous memory allocation. The address space is continuous, as time passed, the old processes will be deleted and the new processes will enter, resulting in plenty of non-avoided bugs. Although there is enough total memory space to satisfy the request, the available space is not contiguous. Internal fragmentation is not a big problem, and the allocated memory may be slightly larger than the requested memory. For paging, external fragmentation is avoided. Physical address space of a process can be noncontiguous; process is allocated physical memory whenever the latter is available.

4.

- a) page number = $20780/1024 = 20$, offset = $20780 \bmod 1024 = 300$
- b) page number = $197015/1024 = 192$, offset = $197015 \bmod 1024 = 407$
- c) page number = $252429/1024 = 246$, offset = $252429 \bmod 1024 = 525$
- d) page number = $1647822/1024 = 1609$, offset = $1647822 \bmod 1024 = 206$

5.

- a) Page number = $1018/2048 = 0$, offset = $1018 \bmod 2048 = 1018$, frame number = 1
 $1 * 2048 + 1018 = 3066$
- b) Page number = $6976/2048 = 3$, offset = $6976 \bmod 2048 = 832$, frame number = 7
 $7 * 2048 + 832 = 15168$

5.

- a) 4KB page size = $4096 = 2^{12}$ bytes, logical memory = $2048 * 2^{12} = 2^{23}$
23 bits are required in the logical address
- b) physical memory = $512 * 2^{12} = 2^{21}$
21bits are required in the physical address