

Operating Systems exercises – week 7 – Selected answers

Memory management questions.

1) Explain the difference between logical and physical addresses.

Answer:

- Logical addresses are those generated by user programs relative to location 0 in memory.
- Physical addresses are the actual addresses used to fetch and store data in memory.

2) Explain the difference between internal and external fragmentation.

Answer:

Internal fragmentation is the area in a region or a page that is not used by the job occupying that region or page. This space is unavailable for use by the system until that job is finished and the page or region is released.

3) Explain the following allocation algorithms:

- a. First-fit
- b. Best-fit
- c. Worst-fit

Answer:

- a. First-fit: search the list of available memory and allocate the first block that is big enough.
- b. Best-fit: search the entire list of available memory and allocate the smallest block that is big enough.
- c. Worst-fit: search the entire list of available memory and allocate the largest block. (The justification for this scheme is that the leftover block produced would be larger and potentially more useful than that produced by the best-fit approach.)

4) Given memory partitions of 200K, 425K, 100K, 700K, and 300K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory?

Remember that space left over after a process has been placed in a partition will then become part of the free space available for later allocations.

No answer – question and answer to be included in portfolio that is to be handed in.

5) Consider a logical address space of eight pages of 1024 words each, mapped onto a physical memory of 32 frames.

- a. How many bits are there in the logical address?

b. How many bits are there in the physical address?

Answer:

- a. Logical address: 13 bits
- b. Physical address: 15 bits

6) Why is it that, on a system with paging, a process cannot access memory it does not own? How could the operating system allow access to other memory? Why should it or should it not?

Answer:

An address on a paging system is a logical page number and an offset. The physical page is found by searching a table based on the logical page number to produce a physical page number. Because the operating system controls the contents of this table, it can limit a process to accessing only those physical pages allocated to the process. There is no way for a process to refer to a page it does not own because the page will not be in the page table. To allow such access, an operating system simply needs to allow entries for non-process memory to be added to the process' page table. This is useful when two or more processes need to exchange data — they just read and write to the same physical addresses (which may be at varying logical addresses). This makes for very efficient interprocess communication.

Linux interprocess communication exercises.

14) Now we will do the same, but using pipes to communicate between the parent and child process.

For this we can use your existing program with the reads, writes and close just as before. The difference is that instead of using open() to open/create a shared file, we will use the pipe() system call to create a pipe.

So you can delete the statement that opens a file, as we no longer need it.

Remember from the lecture that a pipe is just a buffer with 2 file descriptors associated with it fda[0] for reading and fda[1] for writing.

You will need to add the declaration

```
int fda[2];
```

The pipe() system call takes the file descriptor array e.g. fda as its parameter. You should call pipe() as follows,

```
if (pipe(fda) == -1)
    printf("error creating pipe\n");
```

The parent process will need to close the pipe for reading

```
close(fda[0]);
```

while the child process will need to close the pipe for writing

```
close(fda[1]);
```

Reading and writing are as before except you will need to use fda[0] as the file descriptor for reading and fda[1] for writing.

No answer – question and answer to be included in portfolio that is to be handed in.

Answers to earlier and later exercises not given as there is too much overlap between the answer to this question and the answer to them.