Review Session 3

Q1) What are the main resources consumed by the file system in performing its tasks ?

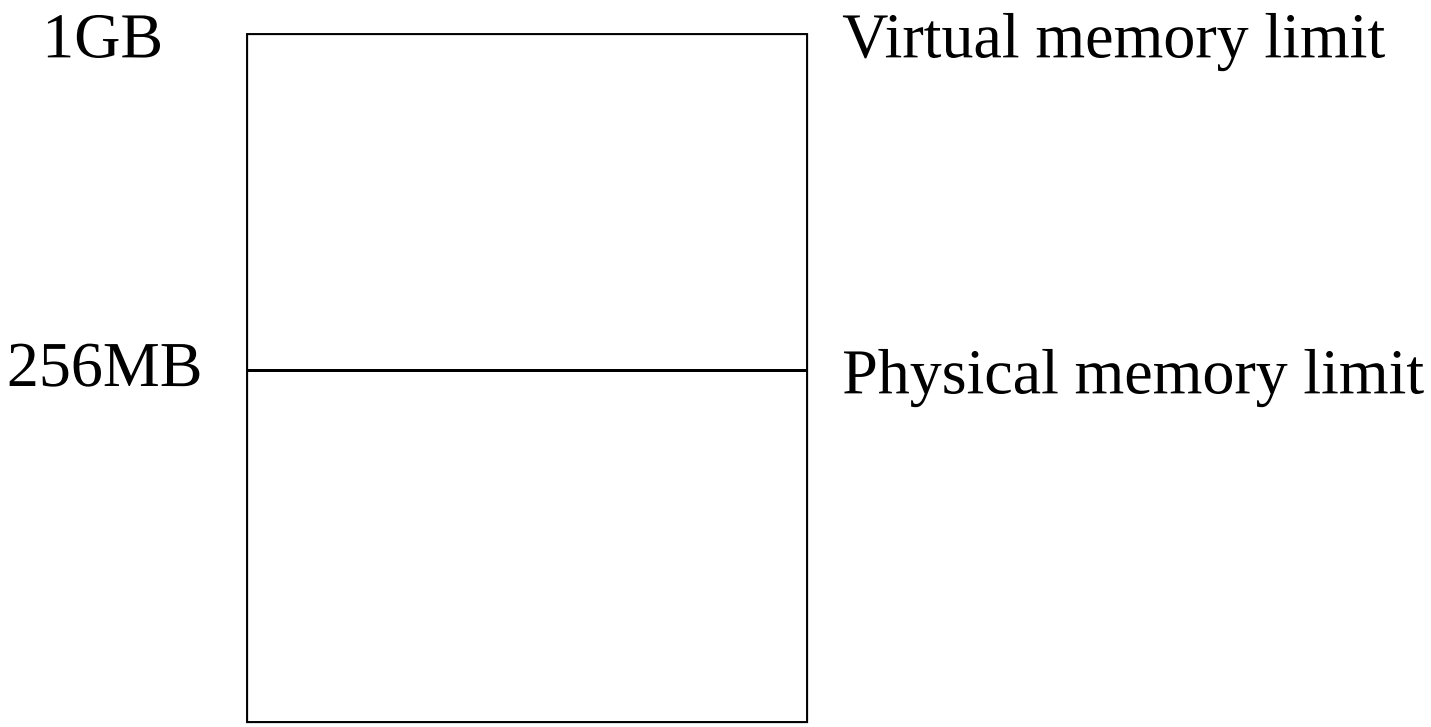
Ans:

CPU time,
memory,
disk space.

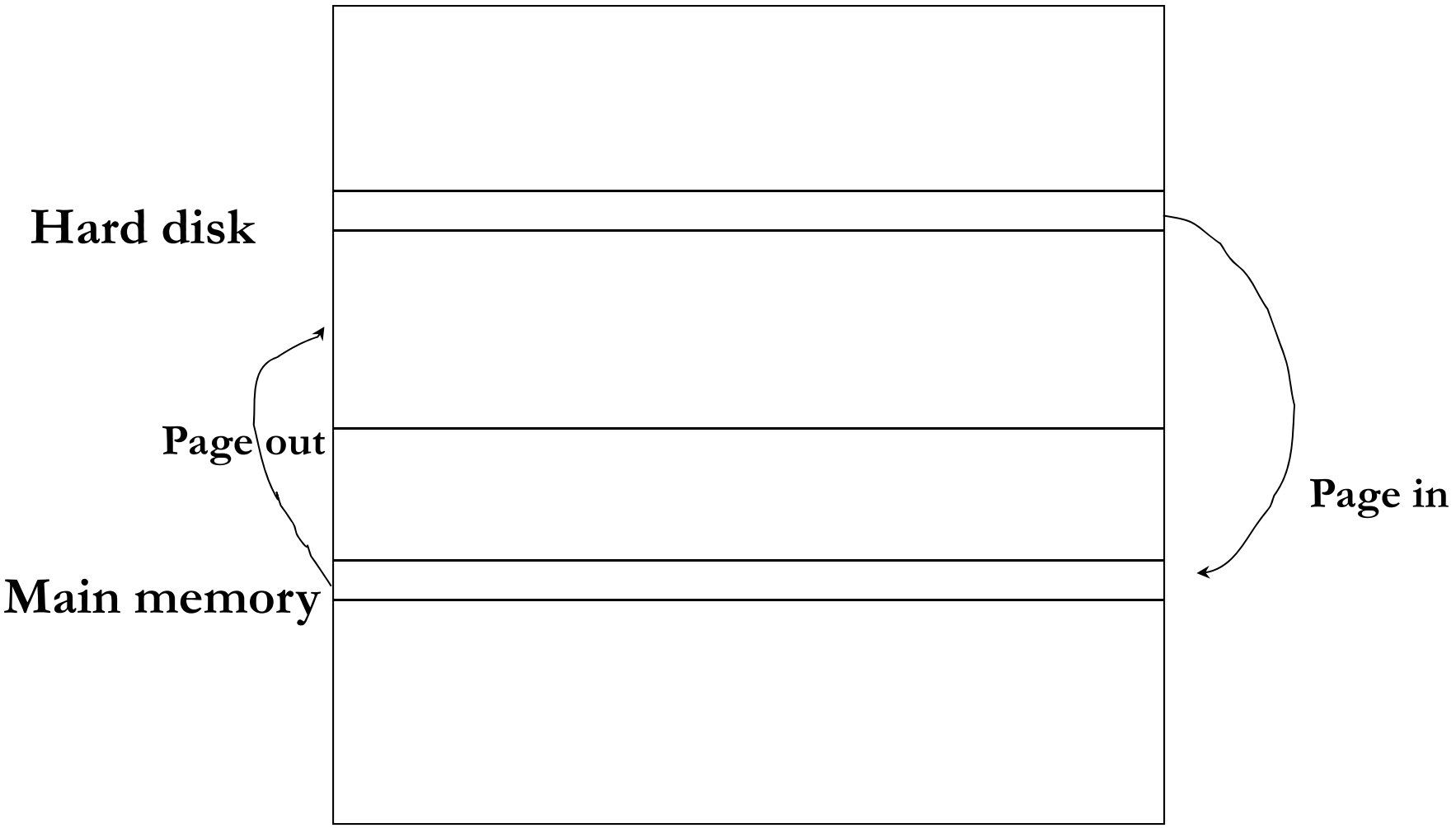
Memory Management

- Virtual memory
  - hard disk space
  - when processor needs more RAM space, swaps data onto designated hard disk space
  - improves flexibility but is slower than RAM to which the processor has direct access

Virtual Memory



Virtual memory



Q2) Assume Process A needs 5 pages of memory. When the CPU runs the process, it requests data from each of the 5 pages with equal probability. Assume that the average time to read a word of data from main memory is 5 ns. Assume the average time to read/write a page from hard disk from/into main memory is 8000ns. Assume no caching and all pages in memory are dirty. What is the average access time to read a word of data if

a) All 5 pages of process A are stored in main memory?

b) 3 pages of process A are stored in main memory at one time (the content of the other 2 are on hard disk)?

c) 1 page of process A is stored in main memory at one time (the content of the other 4 are on hard disk) ?

Ans:

a) *5 ns*

b) *5 ns * 3/5 + (5ns + 8000ns + 8000ns)(2/5)*

c) *5 ns * 1/5 + (5ns + 8000ns + 8000ns)(4/5)*

If CPU requests data from a page swapped to disk, the OS cannot simply read data from that page back into memory. It must first swap data from one of the existing memory pages out to disk to free up one page of memory.

Exercise

- All conditions and assumptions being the same as given in Q2 except that not all pages in main memory are dirty – the probability of a page being dirty is 0.6.

  What is the average access time to read a word of data if

  a) All 5 pages of process A are stored in main memory?

  b) 3 pages of process A are stored in main memory at one time (the content of the other 2 are on hard disk)?

  c) 1 page of process A is stored in main memory at one time (the content of the other 4 are on hard disk) ?

Exercise

- Design and then implement a voting circuit with three inputs and one output, where the output is 1 if the number of inputs in 1 is in majority, otherwise, the output is 0. Follow the following steps:
- Build a Truth Table to derive the abovementioned Boolean function and write down the corresponding logic expression in Sum-of-Products form. **(6 marks)**
- Lay out in Sum-of-Products form the corresponding Boolean circuit for this function using only AND, OR and NOT gates. **(8 marks)**

- Truth table:
- i1 i2 i3 O
- 0 0 0 0
- 0 0 1 0
- 0 1 0 0
- 1 0 0 0
- **0 1 1 1**
- **1 0 1 1**
- **1 1 0 1**
- **1 1 1 1**
- O = (not i1 and i2 and i3) or (i1 and not i2 and i3) or (i1 and i2 and not i3) or (i1 and i2 and i3)

- Use Sum-of-Products to lay out the corresponding circuit.