Operating Systems (SMH) (Part IA)
Paper 1 Question 4 2004 (10 Marks)

This is from the first section of the course, basic computer organization, with a brief reference to the "swapping" concept mentioned in later lectures.

Different memory types

Note: don't require details on implementation although expect some students will provide such. General comments on size, speed and basic purpose will suffice.

Cache memory is a relatively fast memory made from SRAM (details of SRAM internals not required). It sits between the processor and the main memory being typically faster and smaller than the latter.

Main memory is usually DRAM; this means that it can be far larger than cache memory (typically approximately 1 transistor per bit: not required for answer). However it is also slower.

Registers are the fastest kind of 'memory'; this is in part due to their implementation, and in part due to their co-location with the ALU etc on chip. However the amount of register space is very limited due to the expense and complexity (ports etc).

Disk as memory

Note: looking for swapping since do not cover demand paging etc this year. However it is mentioned in passing and an answer using this as an example is fine.

If an operating system is short on main memory in a multi-programming environment, it can *swap out* a process (i.e. all of its memory contents, etc) to disk, thereby freeing up memory. At this or a later stage a process may also be *swapped in*.

NVRAM uber alles

1 mark for any plausible pro and 1 for any plausible con.

Advantages of this is that the system will be more uniform; in addition hitherto disk accesses will be a lot faster than before.

Disadvantages include: additional cost (NVRAM a lot more expensive per bit than disk) for same size, worse performance in general (due to lack of registers and cache ⇒

all operations on values require memory loads and stores).