

**SECTION A**

( ? Marks)

**Question A.1****? Marks**

In the early days, it was argued that a single cache, because of its ability to adapt to different conditions, was better than two separate caches, i.e., an instruction cache and a data cache. Most modern computers, however, have separate instruction and data caches at the top level. Give as many reasons as you can why two separate caches is better than a single, larger cache.

**Question A.2**

Here is a simple model of a computer with a cache: after each memory access, the processor "computes" for 5 cycles, then generates another memory request. If the requested data is found in the cache, it is returned after one cycle and the process is repeated. If the data is not found in the cache, it is fetched from memory, and returned after 10 cycles.

You may give your answer as a formula. State any assumptions you make.

(a) How long (in clock cycles) does it take this computer to make 1000 memory references if it always hits in the cache?

(b) How long (in clock cycles) does it take this computer to make 1000 memory references if it hits in the cache 98.6% of the time?

**Question A.3**

Wilkes' paper entitled, "Slave memories and dynamic storage" was investigating a way of supporting multiple users in a time-sharing system. What is (are) the ground-breaking observation(s) in this paper that make(s) it a historically important paper?