

Computer Architecture

Assignment 5

(This assignment may affect your programming style, give it a great attention)

Due: Next section.

Notes: This assignment is individual assignment, every student should complete by himself.

1. (5 points) True or false

- a. In Load/store architecture, operate instructions operate only on registers.
- b. The Disadvantage of implementing different address modes, is that it can increase the number of instructions and code size.
- c. Instructions with fixed length are hard to extend and may waste bits from memory.
- d. Non-uniform instruction are complex to be decoded .
- e. RISC ISA usually implement many address modes.

2. (5 points) On modern processors, basic C types on x86 and ARM are self-aligned. “Chars” can start on any byte address, but “2-byte shorts” must start on an even address, “4-byte ints or floats” must start on an address divisible by 4, and “8-byte longs or doubles” must start on an address divisible by 8.

Although, this helps to make memory accesses faster, C compiler have to add some padding instruction to apply the alignment which ends up with a larger memory footage. For example, you would think that the following program will reserve 11 bytes of continues memory.

```
short i;      // 2 byte
char c;       // 1 bytes
double d;     // 8 bytes
```

However, it will actually reserve 16 bytes as C compiler will add padding characters to align the instructions in memory as following:

```
short i;      // 2 byte
char c;       // 1 bytes
char pad[5];  // 5 bytes
double d;     // 8 bytes
```

Based on this information calculate the actual memory footage of the following code, then reorder the instructions to give the minimum memory footage. (If you still need more help, read this [article](#))

```
int x,y;
char c;
short z;
double m;
```