

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

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