CPS311 - Computer Organization

Addressing Modes

For the examples that follow, assume the registers and memory are set up as follows.

```
Register 1 contains 3000

Memory Address      Contents (word)
1000                Some word opcode | R1 | 2000     <-- The instruction to be executed
...
2000                4000
...
2FFC                88
3000                12
3004                73
...
4000                1234
...
5000                5678
...
14000               42
```

Direct (Absolute) mode - the instruction contains the address of the operand

> In the above example, we would use the value at 2000 -> 4000

Memory Indirect (Deferred) mode - the instruction contains the address of a location in memory that contains the address of the operand

> In the above example, since address 2000 contains 4000, we would use the value at 4000 -> 1234

Register Indirect (Register deferred) mode - the instruction specifies a register that contains the address of the operand

> In the above example, since register 1 contains 3000, we would use the value at 3000 -> 12

Auto-increment - same as register indirect, but the register is incremented by the size of the operand after being used as address

> In the above example, we would use the value at 3000 -> 12, and then register 1 would then be incremented to 3004 (since a word is 4 bytes long)

Auto-decrement - same as register indirect, but the register is decremented by the size of the operand before being used as address

> In the above example, since register 1 contains 3000, we would use the value at 2FFC -> 88, and also register 1 would be decremented to 2FFC

Register + Displacement - the instruction specifies a register and a displacement, and these are added to determine the address of the operand

> In the above example, since register 1 contains 3000, we would use the value at
> (3000 + 2000 = 5000) -> 5678

Indexed - the instruction specifies a register and a base address. The contents of the register is multiplied by the size of the item to be addressed, and this product is added to the base address to yield the address of the operand

> In the above example, since register 1 contains 3000, we would use the value at
> (4 * 3000 + 2000 = 14000) -> 42

PC Relative - the instruction specifies a memory location relative to the value in the program counter (which points to the next instruction)

> In the above example, we would use the value at (1004 + 2000 = 3004) -> 73

Register - the instruction specifies a register that contains the value to be used

> In the above example, since register 1 contains 3000, we would use 3000

Immediate - the instruction contains the value to be used

> In the above example, we would use 2000