CSE30321 Computer Architecture I Fall 2007

Midterm Solution (100 Points)

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1. (a) **(10 Points)**

```
IR:     0110 0001 0000 0010  (bin)
        6    1    0    2     (hex)
PC:     4                   (dec)
```

(b) **(20 Points)**

```
R0:     12 (dec)
R1:     -8 (dec)
R2:     4  (dec)
DM[13]: 4  (dec)
```

2. (a) **(15 Points)**

```
lui     $at, 0x1001
add     $at, $at, $t0
lw      $t1, 0($at)
```

(b) **(20 Points)**

$$Cycles = (4+4)+Np(5+4+3+4+3+4+4+3)+N(1-p)(5+4+3+4+3+4+3)+(5+4+3)$$

$$Cycles = 8 + Np(30) + N(1-p)(26) + 12 = 26N + 4Np + 20$$

$$CPI_{Avg} = Cycles/Instructions = (26N + 4Np + 20)/M$$

(c) **(15 Points)**

$$Time_1 = (IC)(CPI)/1GHz$$

$$Time_2 = (1.1)(IC)(.8)(CPI)/f$$

$$Speedup = Time_1/Time_2 = 4$$

$$Time_1/Time_2 = (IC)(CPI)/1GHz \times f/(1.1)(IC)(.8)(CPI)$$

$$Time_1/Time_2 = f/.88Ghz$$

$$Time_1/Time_2 = f/.88Ghz = 4 \rightarrow f = 4 * .88Ghz = 3.52GHz$$

(d) **(12 Points)**

```
Comp_Count start:   $ra = X1 + 4
Comp_Count end:     $ra = X1 + 4
ProcX end:          $ra = X0
```

(e) **(8 Points)**

No, nothing needs to be saved on the stack because it is the callee and it doesn't modify any of the callee-saved registers. (As the callee, `Comp_Count` is responsible to save $\$ra$, $\$fp$, $\$s*$. But since it does not modify any of these, they do not need to be saved on the stack.)