COSE Computer Architecture

Assignment #2

1. a) configuration 1: 640 \* 480 \* 3 = 921,600 bytes per frame  
    configuration 2: 1280 \* 1024 \* 3 = 3,932,160 bytes per frame  
   b) configuration 1: 1024 \* 768 \* 3 = 2,359,296 bytes per frame  
    configuration 2: 2560 \* 1600 \* 3 = 12,288,000 bytes per frame
2. a) configuration 1: 2GB/921600 bytes   
    = 2\*(2^30) / 921600   
    = 2330 frames  
    configuration 2: 4GB/3932160 bytes   
    = 4\*(2^30) / 3932160   
    = 1092 frames  
   b) configuration 1: 2GB/2359296 bytes   
    = 2\*(2^30) / 2359296   
    = 910 frames  
    configuration 2: 4GB/12288000   
    = 4\*(2^30)/12288000   
    = 349 frames
3. a) configuration 1: 256Kbytes / 100Mbit per sec   
    = 256\*(2^10) / (100\*(10^6)/8)   
    = 0.02097152 s  
    = 20.97152 ms  
    configuration 2: 256Kbytes / 1Gbit per sec   
    = 256\*(2^10) / (1\*(10^9)/8)   
    = 0.002097152 s  
    = 2.097152 ms
4. a) P2 has the highest performance expressed in instruction per second  
    P1: 3 / 1.5 = 2  
    P2: 2.5 / 1.0 = 2.5  
    P3: 4 / 2.2 = 1.8  
   b) P2 has the highest performance expressed in instruction per second  
    P1: 2 / 1.2 = 1.7  
    P2: 3 / 0.8 = 3.75  
    P3: 4 / 2 = 2
5. a)   
   P1: cycles = 10 sec x 3 GHz = 10\*3\*10^9 = 30\*10^9 cycles  
    instructions = 30\*10^9 /1.5 = 20\*10^9  
   P2: cycles = 10 sec x 2.5 GHz = 10\*2.5\*10^9 = 25\*10^9 cycles  
    instructions = 25\*10^9 /1.0 = 25\*10^9  
   P3: cycles = 10 sec x 4 GHz = 10\*4\*10^9 = 40\*10^9 cycles  
    instructions = 40\*10^9 /2.2 = 18.2\*10^9  
   b)  
   P1: cycles = 10 sec x 2 GHz = 10\*2\*10^9 = 20\*10^9 cycles  
    instructions = 20\*10^9 /1.2 = 16.7\*10^9  
   P2: cycles = 10 sec x 3 GHz = 10\*3\*10^9 = 30\*10^9 cycles  
    instructions = 30\*10^9 /0.8 = 37.5\*10^9  
   P3: cycles = 10 sec x 4 GHz = 10\*4\*10^9 = 40\*10^9 cycles  
    instructions = 40\*10^9 /2.0 = 20\*10^9
6. # of instructions \* CPI / CPU time   
   a) P1: 2\*10^10 \* 1.2\*1.5 / (0.7\*10) = 5.14 GHz  
    P2: 2.5\*10^10 \* 1.2\*1.0 / (0.7\*10) = 4.28 GHz  
    P3: 1.82\*10^10 \* 1.2\*2.2 / (0.7\*10) = 6.86 GHz  
   b) P1: 1.67\*10^10 \* 1.2\*1.2 / (0.7\*10) = 3.43 GHz  
    P2: 3.75\*10^10 \* 1.2\*0.8 / (0.7\*10) = 5.14 GHz  
    P3: 2\*10^10 \* 1.2\*2.0 / (0.7\*10) = 6.85 GHz
7. a) P1: 2\*10^10 / (7 sec\*3GHz) = 0.95  
    P2: 3\*10^10 / (10 sec\*2.5GHz) = 1.2  
    P3: 9\*10^10 / (9 sec\*4GHz) = 2.5  
   b) P1: 2\*10^10 / (5 sec\*2GHz) = 2  
    P2: 3\*10^10 / (8 sec\*3GHz) = 1.25  
    P3: 2.5\*10^10 / (7 sec\*4GHz) = 0.89
8. a) 2.5 GHz / (7/10) = 3.57 GHz  
   b) 3GHz / (5/8) = 4.8 GHz
9. a) 3\*10^10 \* 9/10 = 27 \* 10^9  
   b) 3\*10^10 \*7/8 = 26.25 \* 10^9
10. a) P2  
    P1: CPU time = (10^6\*0.1\*1 + 10^6\*0.2\*2 + 10^6\*0.5\*3 + 10^6\*0.2\*3)/(2.5\*10^9)  
     = 0.00104 sec  
    P2: CPU time = (10^6\*0.1\*2 + 10^6\*0.2\*2 + 10^6\*0.5\*2 + 10^6\*0.2\*2)/(3\*10^9)  
     = 0.00066 sec  
    b) P2  
    P1: CPU time = (10^6\*0.1\*2 + 10^6\*0.2\*1.5 + 10^6\*0.5\*2 + 10^6\*0.2\*1)/(2.5\*10^9)  
     = 0.00068 sec  
    P2: CPU time = (10^6\*0.1\*1 + 10^6\*0.2\*2 + 10^6\*0.5\*1 + 10^6\*0.2\*1)/(3\*10^9)  
     = 0.0004 sec
11. a)  
    P1: CPI = 0.00104 sec \* 2.5 GHz / 10^6 = 0.00104\*2.5\*10^9/10^6  
     = 2.6   
    P2: CPI = 0.00066 sec \* 3 GHz / 10^6 = 0.00066\*3\*10^9/10^6  
     = 1.98  
    b)  
    P1: CPI = 0.00068 sec \* 2.5 GHz / 10^6 = 0.00068\*2.5\*10^9/10^6  
     = 1.7  
    P2: CPI = 0.0004 sec \* 3 GHz / 10^6 = 0.0004\*3\*10^9/10^6  
     = 1.2
12. a)   
    P1: #clock cycles = 2.6\*10^6 = 2600000  
    P2: #clock cycles = 1.98\*10^6 = 1980000  
    b)  
    P1: #clock cycles = 1.7\*10^6 = 1700000  
    P2: #clock cycles = 1.2\*10^6 = 1200000