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CDA3101
Assignment 1
Computer Measurements

Objectives: Learn how to apply various measurements associated with a computer.

Put all answers on this sheet. Show your work (this is required for full credit and helpful for partial credit).

1.   Consider a computer system, where each processor can independently perform a separate task. Given that the *response time* on a computer system for a single task is 12 seconds, how long would it take to perform 18 tasks on this system when it has four processors? What would be the *throughput* per second for 18 tasks? (20 points)

> Number of processors: 4
> Response time on a comp sys: 12 s
> Number of tasks: 18
>
> Time taken by computer with 4 processors to perform 18 tasks= 12*18= 216
> 216/4= 54 seconds
>
> tasks per second: 18/54=0.333
> Therefore it takes 0.3 seconds to perform a task.

2.   Machine A can perform 3 tasks in 6 seconds. Machine B can perform 2 tasks in 5 seconds. Which machine can perform a task faster? How much faster is this machine than the other. (20 points)

> Machine A: 3 tasks in 6 seconds
> Machine B: 2 tasks in 5 seconds
>
> Machine A can complete one task in 6/3= 2 seconds.
> Machine B can complete one task in 5/2= 2.5 seconds.
>
> Since machine A takes less time to perform a task, only taking 2 seconds, this machine is faster. It is specifically 2.5/2= 1.25 faster.

3. Given that a program on a machine requires an average of 3 cycles per instruction, the machine has a 2 GHz clock rate, and the program executes a total of 40,000,000,000 instructions, what is the CPU time in seconds required by this program? (20 points)

Cycles per Instruction: 3 units
Clock rate: 2 GHz
Instructions: 40,000,000,000

CPU time= (instructions* Cycle Per Instruction) /Clock rate
= instructions*(Cycle per instruction/ instructions)*(time(seconds)/cycles)
CPU Time= 3(40,000,000,000)/2= 60,000,000,000 seconds

40,000,000,000*3 *1/clock rate

40,000,000,000*3*1/2*109 seconds

4.   How many gibibytes is 0.32 Tib? (10 points)

        1 Tib= 1024 gibibytes
        0.32*1024=327.68

5.   The portion of time a program spends performing floating-point operations is 25%. A new floating-point co-processor would perform floating-point operations five times as fast. Given that the execution time of a program required 40 seconds without the new floating-point co-processor, what would you expect the execution time of the program to be in seconds with the new floating-point co-processor? (20 points)

                                        25% is on floating point
                                        New floating point co-processor performs them 5 times faster
                                        Program takes 40 seconds without improvement

                                        Out of the 40 seconds 25% are used for floating points which equals to 10 seconds.
                                        Time spend with other floating point operations 40-10=30

                                        Processor that performs the operation 5 times faster spends 10/5=2 seconds.
                                        ~~Since there is no enhancement in 85% of the program this will continue consuming 34 seconds worth the floating point processor.~~
                                        The processor with floating point co-processor will consume 30+2= 32 seconds to execute.

6.   Suppose the clock period is 250 picoseconds. What is the clock rate in gigahertz (GHz)? (10 points)

                                        1 picosecond= 10^{-12}
                                        1 GHz= 1/sec =$1/10^{-12}$ = $10^{12}*1/$seconds=10^{12} GHz
                                        Therefore 1 picosecond= 10^{12} GHz
                                        250 picoseconds= $250*10^{-12}$
                                        Clock Rate = $1/250*10^{-12}$ sec = 4000000000GHz