Assignment – 02

You Must Mention Your Name, ID And Section In The Script And Write The Answers In The Provided Space.

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Section A (8 Marks)

Suppose, you are a developer of a software company named 'HackerMan'. Your supervisor asked you to develop a password program, for MIPS architecture, that can both generate passwords and break them. After building the program, you observed that the program was taking **X milliseconds** to execute and the password generation was taking **90%** of the total execution time (*Here X is your BRACU ID. For example, if your ID is 12456789 then the time is 12456789 milliseconds*).

After reporting to your boss fearfully, he said it was unacceptable and threatened to fire you unless you can increase the whole program's performance by a factor of **5** by optimizing the password generation.

Now, your job's future rests in your optimization skills and the results of your analysis. Let's start with the analysis.

Question 1: You need to improve the password generation operation by a factor of what, to meet the requirements? Is it even possible to meet the requirements? If not then why? *[4 Marks]*

In the meantime, you are thinking if you can decrease the execution time of the password breaking operation. You thought of a slight optimization of that operation and made some rough calculations: the optimized algorithm would have an average CPI of **Y** and instruction count of **$Y*10^7$** (*Here Y is the third digit of your BRACU ID. For example, if your ID is 12456789 then instruction count will be 4*$*10^7$). Now answer the following question.

Question 2: How much processing speed would you require for running the optimized algorithm? [*4 Marks*]

ANSWER OF SECTION A:

1. Execution time = 17301107 millisecond

Password generation taking = $\frac{90}{100} \times 17301107$ =15570996.3 millisecond

Execution time (factor of 5) = $\frac{17301107}{5}$ =3460221.4 millisecond

3460221.4 = $\frac{15570996.3}{n}$ + 1730110.7

=>n = $\frac{15570996.3}{1730110.7}$ = 9

It is possible to meet the requirements.

2.

Cpu time = 17301107 millisecond = 17301.107 Second

Average CPI = 3

Instruction count =3×10^7

Total CPU Clock cycle =$Average\ CPI \times Instruction\ count$ = 90000000

Clock Rate = $\frac{CPU\ Clock\ Cycle}{CPU\ Time}$ = $\frac{90000000}{17301.107}$ = 5201.97927219 Hz

Section B [7 Marks]

Suppose you are running the SPEC CINT2006 benchmarking program and the program ran three separate programs listed below:

Program Name	Instruction Count (x10^9)	Clock Rate (GHz)	CPI	Execution Time	Reference Time	SPEC Ratio
BFG	P+1 = 1+1 =2	2.4	2.5	?	86	?
Vega	Q+1 =0+1 =1	2.4	2.0	?	12	?
Checker	R+1 = 7+1 =8	2.4	3.0	?	15	?

Here P, Q, R are the 6th, 7thand 8th digit of your BRACU ID.

BRACU ID = 17301107

1. **Now determine the execution time and SPEC ratio for BFG, Vega and Checker programs. [*4 Marks*]**
2. **Calculate the Geometric Mean. [*3 Marks*]**

ANSWER OF SECTION B:

1.

Execution time for 'BFG' = $\frac{Instruction\ Count \times CPI}{Clock\ Rate}$ = $\frac{2 \times 2.5}{2.4}$ = 2.083333333

SPEC ratio for 'BFG' = $\frac{Reference\ time}{Execution\ time}$ = $\frac{86}{2.083333333}$ = 41.28000001

Execution time for 'Vega' = $\frac{Instruction\ Count \times CPI}{Clock\ Rate}$ = $\frac{1 \times 2.0}{2.4}$ = 0.8333333333

SPEC ratio for 'Vega' = $\frac{Reference\ time}{Execution\ time}$ = $\frac{12}{0.8333333333}$ = 14.4

Execution time for 'Checker' = $\frac{Instruction\ Count \times CPI}{Clock\ Rate}$ = $\frac{8 \times 3.0}{2.4}$ = 10

SPEC ratio for 'Checker' = $\frac{Reference\ time}{Execution\ time}$ = $\frac{15}{10}$ =1.5

2.

Geometric mean = $\sqrt[3]{41.28000001 \times 14.4 \times 1.5}$ = 9.624935178