NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

BE (CS) Batch: 2015-16

Spring Semester 2019 (30-03-2019) Computer Systems Modeling (CS-417)

Assignment I

1. Following program segment A finds the sum of cubes of elements in a vector X = {x_1, x_2, …, x_n}:-

```
s = 0;
for (i=1; i<=N; i++)
        s = s + x[i] * x[i] * x[i];
```

   a) Compute the execution rate, R_1, and execution time, t_1, of above segment on a processor with clock rate 250MHz and t_a=5 cycles, t_m= 10 cycles.
   b) Write down the modified segment B for avoiding the evaluation of cube for elements with zero value.
   c) Compute the execution rate, R_2, and execution time, t_2, of program segment B on the same processor given that t_{if}=4 cycles and 15% elements of X are zero.
   d) Compute the speedup and relative change of segment B over A.
   e) Show that ends-based metrics are more reliable than means-based metrics from the above results.

2. In designing a new computer system, we make an enhancement that improves some mode of execution by a factor of ten. This enhanced mode is used 50% of the time, measured as a percentage of the execution time when the enhanced mode is in use. (Recall that Amdahl's law uses the fraction of the original, unenhanced execution time that could make use of the enhanced mode. Thus, we cannot directly use this 50% measurement to compute the net speedup using Amdahl's law.)
   a) What is the speedup that we have obtained by using this fast mode?
   b) What percentage of the original execution time has been converted to fast mode?

3. Two different enhancements are being proposed for a new computer system. Enhancement 1 produces a speedup of 25 and enhancement 2 produces a speedup of 15. Only one enhancement can be in use at any one time. If enhancement 1 is usable for 30% of the unenhanced execution time, what fraction of this time must enhancement 2 be used to achieve an overall speedup of 5. **Note:** Use fixed-computation version of Amdahl's law.

NOTE

i. Assignment is on individual basis
ii. To be prepared by hand
iii. Last date of submission: **Thu 11th Apr, 2019**

SYED ZAFFAR QASIM
Assistant Professor (CIS)