CS525-HW3

Due Date: Thursday, Oct 30

Q1) A parallel program has 1% serial component (i.e., one percent of the work is serial). The program is executed on 1000 cores. What is the maximum speedup? What is the maximum efficiency?

Q2) The serial runtime of a program is $t_c * n$ (where t_c is the time for a basic operation). The parallel runtime for the same program is $\frac{t_c * n}{p} + log(p)$. If the program achieves efficiency of 0.75 on 16 cores for n = 10M, what will its efficiency be for the same n at 1024 cores?

Q3) The serial runtime of a program is $t_c * n$ (where t_c is the time for a basic operation). The parallel runtime for the same program is $\frac{t_c * n}{p} + log(p)$. If the program achieves efficiency of 0.75 on 16 cores for n = 10M, what should n be to achieve the same efficiency on 1024 cores?

Q4) The serial runtime of a program is n^2. The parallel runtime of the program is $\frac{n^2}{p} + n * p * log(p)$. What is the cost ($p * T_p$ product) of the parallel system? Is the system cost optimal? What is the largest number of processors for which the system is cost optimal?

Q5) The serial runtime of a program is n^2. The parallel runtime of the program is $\frac{n^2}{p} + n * p * log(p)$. What is the isoefficiency of the system?

Q6) The total overhead associated with a serial program with work W is $\sqrt{W} * p * log(p)$. What is the isoefficiency of the system?

Q7) The serial runtime of a program is n^2. The parallel runtime of the program is $\frac{n^2}{p} + n * p * log(p) + p^2$. What is the isoefficiency of the system?

Q8) The memory complexity of the program in the previous question is n^2. Assume that memory scales linearly in the number of cores. What is the memory constrained speedup of the program in the previous question?

Q9) What is the time constrained speedup for the same problem?

Q10) What is the efficiency under weak scaling for the same problem?