Assignment #4b and 5a

Due on Tuesday, December 8, 2009

Problem 1. Draw a simple data dependency graph for the following set of statements. Explain the type of dependency for each dependency arc. Allocate the optimum number of processors needed for fine grain concurrency, and estimate the minimum time needed for execution. Assume that there is no communication overhead for transferring data between two processors. Assume that the variables X and Z are aliases.

X = 4; Y = 7; W = X + Y; Z = 2 * Y ; M = Y + W ; S = 2 * Z ; X = W ;

Problem 2. For Problem 1, assuming that each data transmission between two processors takes 50 units of time, compute the total execution time after exploiting fine grain parallelism. Use program slicing to improve the execution time. Justify your answer.

Problem 3. Assuming you have a 50 processor machine for the following computation. Each computation takes one unit of time, and data transfer between two processors takes 50 units time, parallelize the following nested loop to get minimum time. You may use program slicing if needed. Justify your solution.

int a[10000, 10000], b[10000, 10000], c[10000, 10000];
for (i = 0; i <= 9999, i++)
for (j = 0; j =< 9999; j++)
read(a(i, j), b(i, j));
for (i = 0; i <= 9999, i++)
for (j = 0; j =< 9999; j++)
c(i, j) = a(i, j) + b(i, j);

Problem 4. Solve the nested lambda expressions using both AOR and NOR technique. Clearly mark a and b reductions. Nesting has been shown using parenthesis. Within the same level, substitution is done in left to right order.

λz.λw (λx.λy. x * x + 3 * y + 4) z + w z – w) 3 2

Problem 5. Conceptual type

5a. What to you understand by lambda calculus? What are its components? Explain using a single example.

5b. What do you understand by function forming operators? Explain each function forming operator using a simple example not given in the slides or any book.

5c. What do you understand by predicate calculus? How is it different from propositional calculus? Explain.

5d. What do you understand by And-OR tree? Explain using a simple example.

5e. What do you understand by unification. Show step by step unification of the following logical terms:

a([5, L, H], N, H) and a([L, N, M], 5, 4).

If the unification succeeds then give the set of substitutions for variables and give the final term after substituting the variables by their corresponding values.

5f. What do you understand by fine grain and coarse grain concurrency? What are the problems in fine grain parallelism? Explain using an example not covered in the class.

5g. What do you understand by program slicing? Explain using an example not covered in the class.