

CMPT 418 Assignment 2

(due by December 4, 6 pm)

(to be accomplished in teams of two people)

Collaborative Problem Solving

You have to design a multi-agent system where agents distribute tasks and collaborate to accomplish them. There are two types of agents: *calculators* and *contractors*. Each *calculator*-agent has a certain arithmetic capability. Some agents are adders, some are subtractors, some are multipliers and some are dividers. There are some more capable calculators, that can both add and subtract and others that can both multiply and divide. The *contractor-agents* can not do any of the primitive calculations, but can parse arithmetic expressions and prioritize the execution of computations and contract out primitive calculations of sub-expressions to the calculator-agents. In the sub-contracting process they aim to fit the calculation of the task within its assigned budget. Each calculator agent charges its own fixed price for performing its service.

Your task is, using JADE as a multi-agent platform and the Contract Net Protocol, to design a multi-agent system where tasks, consisting of complex arithmetic expressions, can be computed by the agents. Each task comes with its own “budget” that is given. The tasks arrive in a batch. Your system should arrange the delegation of each task to a contractor that is free at the time and return the results of the task-batch to the user, where each task-result is either the result of the expression, if a solution can be found within the budget of the task or “failed”, if it wasn’t possible to compute the task within its budget. Note, that the system may have to reassign a task with low budget several times if, for example, the cheapest multiplication agent was never available, when the task was subcontracted. For simplicity, you can assume that the expressions contain only numbers (integer or real), simple arithmetic operations (+, -, *, /) and brackets.

One possible way to implement the “expertise” of the contractor-agents is to parse arithmetic expressions and sub-contract all primitive sub-expressions that contain numeric operands. The contractor agent can also convert the expression in Reverse Polish notation. Check: http://en.wikipedia.org/wiki/Reverse_Polish_Notation

In the documentation of your submission, please, indicate how many contractor agents you have and how many calculator agents you have for each type of action and for how much each of them charges. For example, you may have 2 adders that charge 1 clams, 2 adders that charge 2 clams, and 1 adder that charges 3 clams, etc. Also, include 5 task - batches which you used to test your system and the time it took to generate the solution for each batch. Each batch should have at least as many tasks as there are contractor agents in the system.

Syntax: A task **batch** would look like this: { [2+(2.5*2)/7.0; 4], [3.4+2.3*17-(1/0.5); 4]}. Here { ... } delimit the batch, [...] delimit a task in the batch, the tasks in one batch are separated by “,”. Each **task** [contains the expression to be computed; followed by an integer showing its budget, separated by “;”].