IMPLEMENTATION OF A CONCURRENT MULTI-AGENT ROBOTIC SYSTEM

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OUTLINE

- Review
- Overview of program structure
- Concurrency issues
- Some results
- Possible future extensions

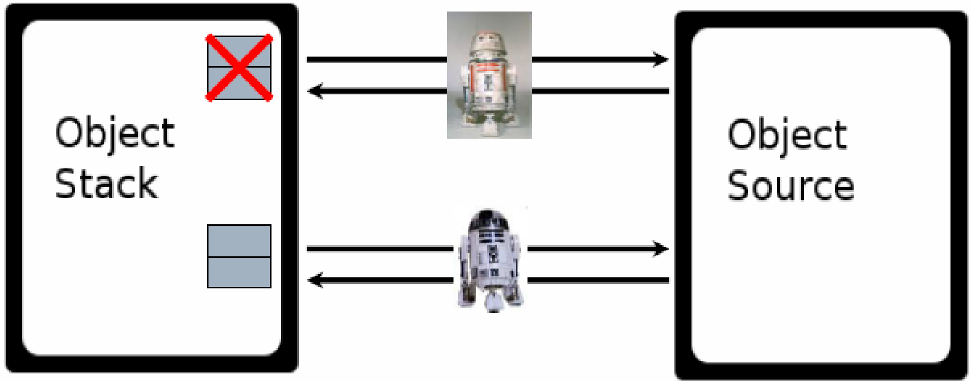
REVIEW OF PROBLEM

Task 1:
See an object
Move to object
Pick up object
Move to home

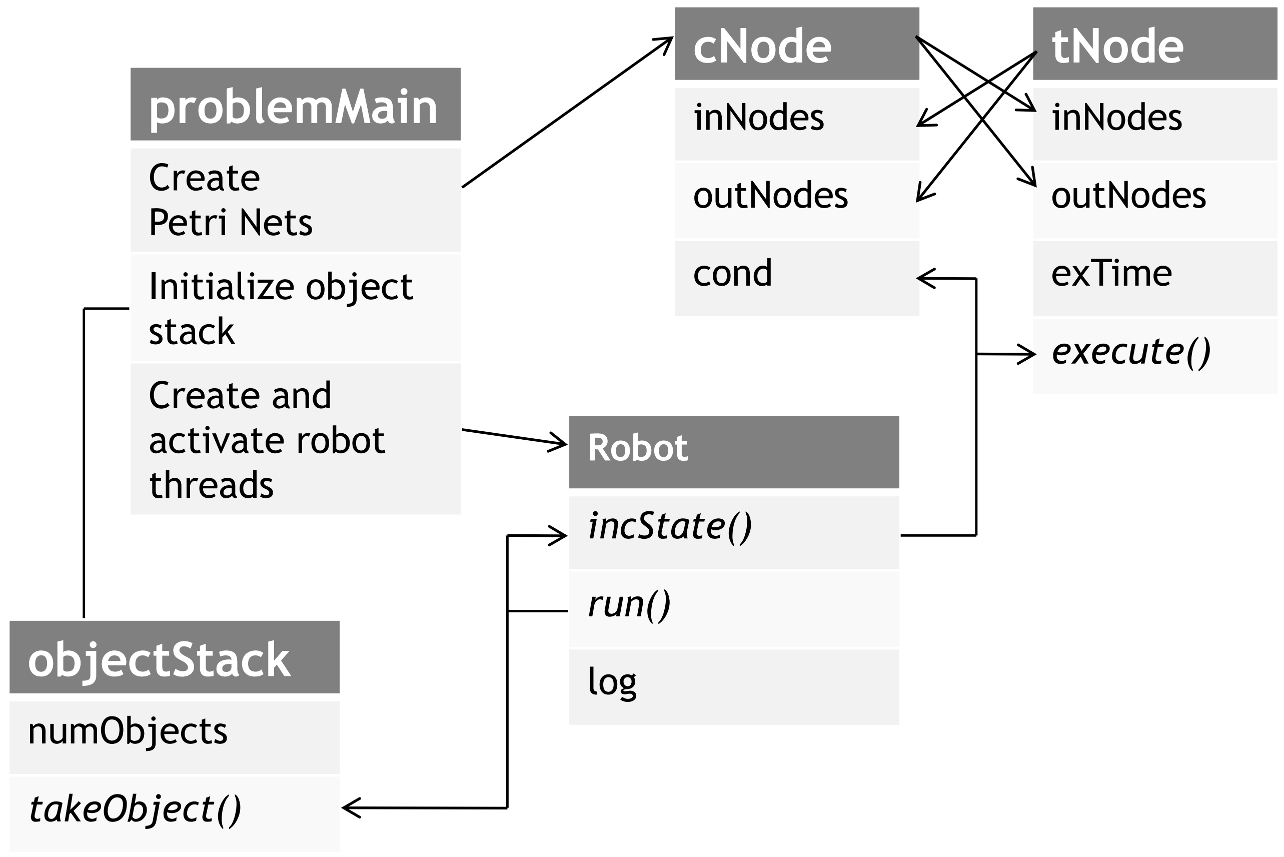
~~**Task 2:**~~
~~Stack object~~

Task 1:
See an object
Move to object
Pick up object
Move to home

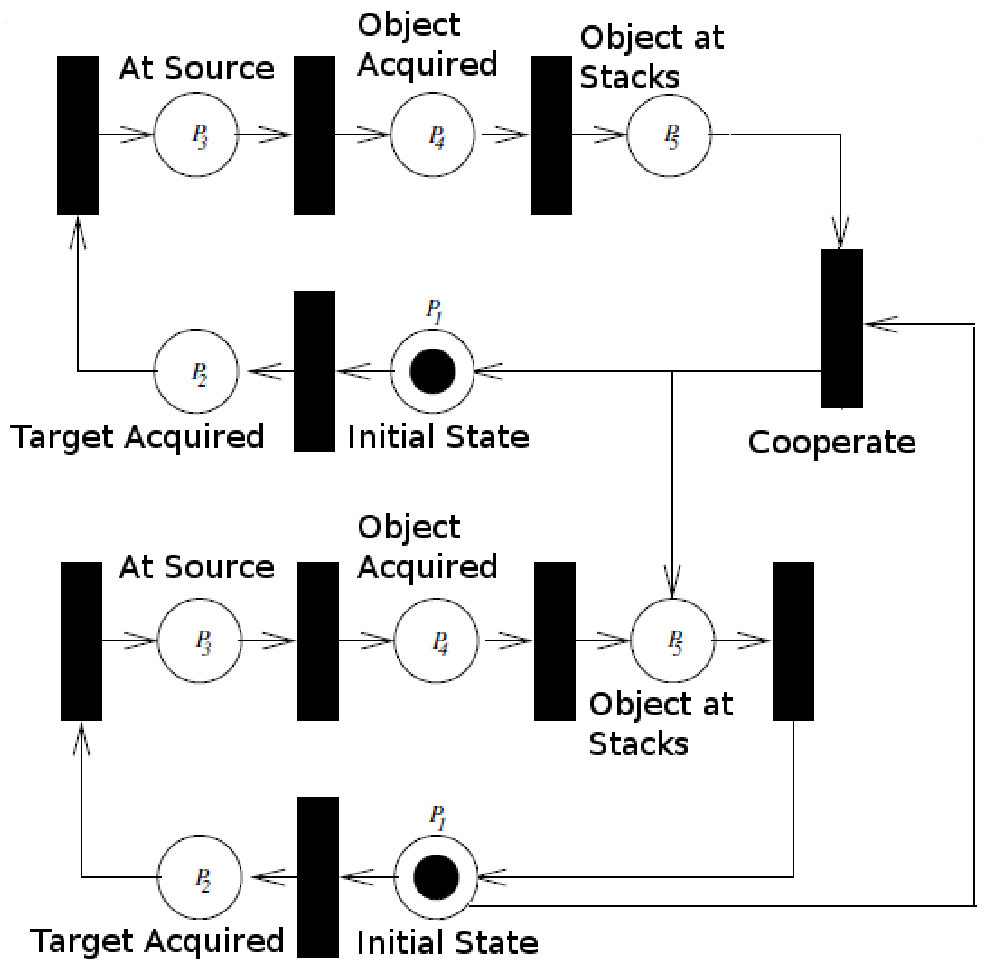
Task 2:
Stack object



PROGRAM STRUCTURE



PROGRAM STRUCTURE



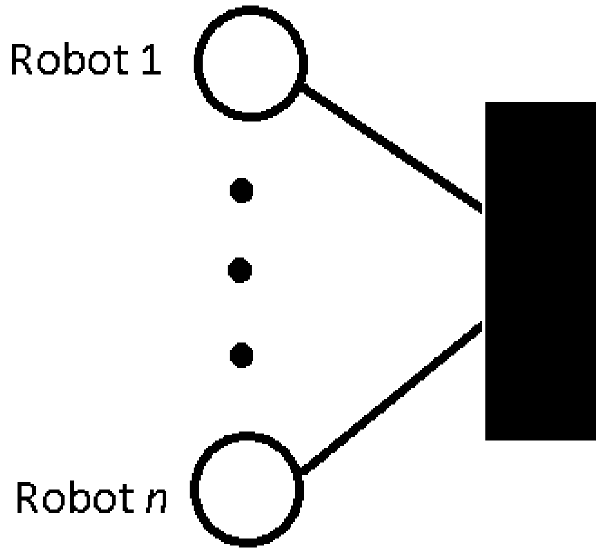
CONCURRENCY ISSUES

Must maintain an accurate count of objects remaining to be delivered.

When cooperating, robot threads must not be able to advance from the condition to the action until all parties have entered the pre-condition.

CONCURRENCY ISSUES

Used Semaphores to handle both cases.



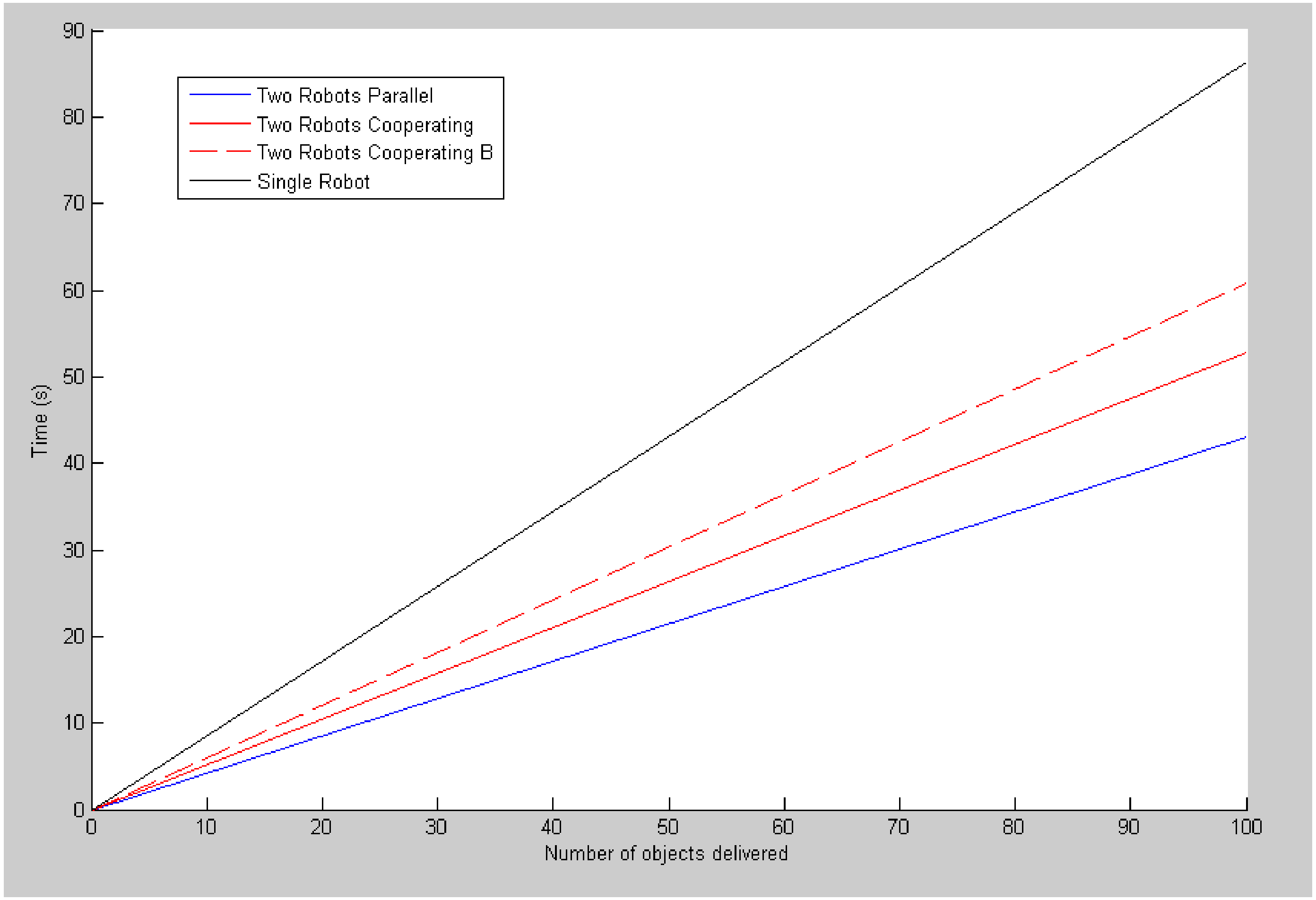
Create a semaphore vector, S, with n elements for the action node.
When robot 1 arrives at the pre-condition, it produces (*n*-1) release calls to S(1), and then makes a single acquire call to S(2),...,S(*n*).
Likewise with robots 2,...,*n*

RESULTS

- Looked at four different situations:
  - A single robot
  - Two fully functional robots acting in parallel
  - One functional, one damaged robot cooperating
  - One functional, one damaged robot cooperating with timing shifted

Action:	See Object	Move to Object	Pick up Object	Return Home	Stack Object
Standard:	50	300	150	300	100
Alternate:	100	100	250	100	250

RESULTS


Two Robots Parallel
Two Robots Cooperating
Two Robots Cooperating B
Single Robot
Time (s)
Number of objects delivered
0
10
20
30
40
50
60
70
80
90
100

FUTURE EXTENSIONS

- Have multiple object stacks to collect from
  - Prevents bottleneck at object source
  - Increases complexity of object acquisition and determining robot thread end conditions
  - Likely implemented using a tryAcquire loop over active (still containing objects) stacks
- Scale past two robots
  - Increases complexity of determining robot thread end conditions
- Intelligently planned cooperation
  - Increases network navigation complexity

QUESTIONS?