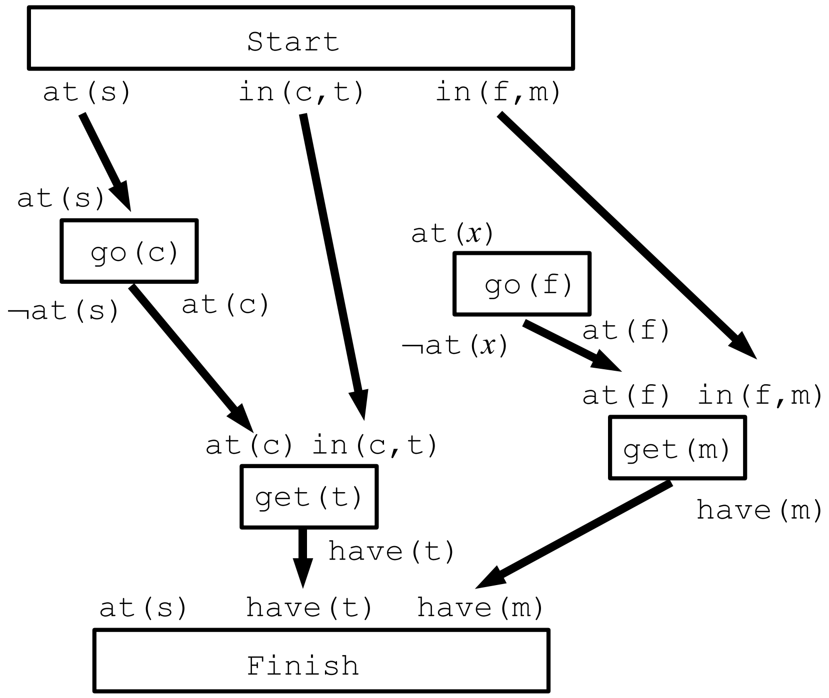
2008 Paper 11 Question 5

Artificial Intelligence I

A brilliant student has finished his exams and is making a well-deserved cup of tea. He is confused, however, and is trying to use the *partial order planning* algorithm to solve part of the problem. Using the abbreviations `f` for "fridge", `c` for "cupboard", `s` for "sink", `m` for "milk" and `t` for "tea", his start state is $\{\texttt{at}(\texttt{s}), \texttt{in}(\texttt{c},\texttt{t}), \texttt{in}(\texttt{f},\texttt{m})\}$. Using x and y to denote variables, he has two actions. The first action is $\texttt{get}(y)$ having preconditions $\texttt{at}(x)$ and $\texttt{in}(x,y)$, and effect $\texttt{have}(y)$. The second action is $\texttt{go}(y)$ having precondition $\texttt{at}(x)$ and effects $\neg\texttt{at}(x)$ and $\texttt{at}(y)$. His goal is $\{\texttt{at}(\texttt{s}), \texttt{have}(\texttt{t}), \texttt{have}(\texttt{m})\}$. So far he has made the following attempt at finding a plan:



In this diagram, arrows denote causal links.

(*a*) Can the $\texttt{at}(x)$ precondition on $\texttt{go}(\texttt{f})$ be achieved by adding an ordering constraint and causal link from `Start` to $\texttt{go}(\texttt{f})$, and perhaps one or more further ordering constraints, in such a way that the plan remains valid? Explain your answer. [4 marks]

(*b*) Describe a method, different from any suggested in part (*a*), by which the $\texttt{at}(x)$ precondition on $\texttt{go}(\texttt{f})$ can be achieved in such a way that the plan remains valid. [8 marks]

(*c*) Describe a way in which the plan can be completed after making the addition you have described in part (*b*). [8 marks]