

# **Artificial Intelligence Project 2 Report**

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- **Fluents used in the project, what they mean, and a description of their arguments.**

**agentState/4:** This predicate represents the agent's current food (F), materials (M), and energy (E) levels at a particular state S. The values of F, M, and E change as the agent performs actions.

`agentState(F,M,E,s0):-`

`food(F), materials(M), energy(E).`

`agentState(F,M,E,result(A,S)):-`

`(agentState(F2,M,E,S),A=reqf,F is F2+1);`

`(agentState(F,M2,E,S),A=reqm,M is M2+1);`

`(agentState(F,M,E2,S),A=reqe,E is E2+1);`

`(agentState(F2, M2, E2, S),A=b1 ,build1(FReq, MReq, EReq),  
F2 >= FReq, M2 >= MReq, E2 >= EReq, F is F2 - FReq, M is M2 - MReq, E  
is E2 - EReq);`

`(agentState(F2, M2, E2, S),A=b2 ,build2(FReq, MReq, EReq),  
F2 >= FReq, M2 >= MReq, E2 >= EReq, F is F2 - FReq, M is M2 - MReq, E  
is E2 - EReq).`

**The arguments of agentState/4 are:**

F: Represents the amount of food.

M: Represents the amount of materials.

E: Represents the amount of energy.

S: Represents the current state.

- **An explanation of the successor state axioms we implemented.**

The successor state axioms are implicitly defined within the recursive rules of the **agentState/4** predicate. Successor state axioms describe how the state changes after the execution of an action. Here's a breakdown of the successor state axioms for each type of action:

Axiom	Description
<code>agentState(F,M,E,S), reqf, agentState(F+1,M,E,result(reqf,S))</code>	When the agent requests food (reqf), its food level increases by 1.
<code>agentState(F,M,E,S), reqm, agentState(F,M+1,E,result(reqm,S))</code>	When the agent requests materials (reqm), its materials level increases by 1.
<code>agentState(F,M,E,S), reqe, agentState(F,M,E+1,result(reqe,S))</code>	When the agent requests energy (reqe), its energy level increases by 1.
<code>agentState(F2,M2,E2,S), b1, build1(FReq,MReq,EReq), F2 &gt;= FReq, M2 &gt;=</code>	When the agent performs building action 1 (b1), it consumes the specified resources (FReq, MReq,

MReq, E2 >= EReq, agentState(F2-FReq,M2-MReq,E2-EReq,result( b1,S))	EReq) and its state is updated accordingly.
agentState(F2,M2,E2,S), b2, build2(FReq,MReq,EReq), F2 >= FReq, M2 >= MReq, E2 >= EReq, agentState(F2-FReq,M2-MReq,E2-EReq,result( b2,S))	When the agent performs building action 2 (b2), it consumes the specified resources (FReq, MReq, EReq) and its state is updated accordingly.

These rules capture the changes in the agent's state (fluents) based on the different actions that can be performed.

- **Some test cases, their outputs, and how long it takes to run.**

Query #	Query	Output	Time
Query1 (given)	goal(S).	Output1: S = result(b1, result(reqf, result(reqm, result(reqm, result(reqe, result(b2, result(reqf, result(reqf, result(reqf, result(reqm, s0))))))))))	60.155 CPU in 60.156 seconds
Query2 (given)	goal(result(b1,result(reqf,result(req m,result(reqm,result(reqe,result(b2, result(reqf,result(reqf,result(reqf, res ult(reqm,s0)))))))))).	true.	13.973 CPU in 14.033 seconds
Query3 (given)	goal(result(b1,result(reqf,result(req m,result(b2,result(reqf,result(reqm,r esult(reqm,result(reqf,result(reqe,re sult(reqf,s0)))))))))).	true.	14.140 CPU in 14.140 seconds
Query4 (given)	goal(result(b2,result(reqf,result(reqf, result(reqf,result(reqf,result(reqm,re sult(reqe,result(b1, result(reqm, result(reqm, s0)))))))))).	true.	15.190 CPU in 15.190 seconds
Query5 (given)	goal(result(b1, result(reqf, s0))).	false.	0.000 CPU in 0.000 seconds

Query6	goal(result(b1,result(reqf,result(reqm,result(reqm,result(reqe,s0))))))	false.	0.007 CPU in 0.007 seconds
Query7	goal(S).	Output2: S=result(b1,result(reqf,result(reqm,result(reqm,result(reqe,result(b2,result(reqf,result(reqf,result(reqm,result(reqf,s0))))))))))	0.000 CPU in 0.000 seconds
Query8	goal(result(b1,result(reqf,result(reqm,result(reqm,result(reqe,result(b2,result(reqf,result(reqm,result(reqf,result(reqf,s0)))))))))).	true.	14.107 CPU in 14.107 seconds
Query9 On KB2	goal(S).	Output1: S=result(b1,result(reqf,result(reqf,result(reqm,result(reqe,result(b2,result(reqf,s0))))))	0.636 CPU in 0.636 seconds
Query10 On KB2	goal(result(b1,result(reqf,result(reqf,result(reqm,result(b2,result(reqf,result(reqe,s0)))))))).	true	0.134 CPU in 0.134 seconds
Query11 On KB2	goal(result(b1,result(reqf,result(reqf,result(reqm,result(reqe,result(reqf,s0)))))).	false.	0.037 CPU in 0.037 seconds