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**CSCE 625: Homework #7**

**1.a)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Smart** | | | **¬Smart** | |
| **Study** | **¬Study** | **Study** | | **¬Study** |
| **Pass** | 0.114 | 0.126 | 0.168 | | 0.084 |
| **¬Pass** | 0.006 | 0.054 | 0.112 | | 0.336 |

**1.b)**

P(smart | pass,¬study) = 0.126 / (0.126+0.084) = 0.6

**1.c)**

P(¬study | smart,¬pass) = 0.054 / (0.054+0.006) = 0.9

**1.d)**

P(pass | smart) = (0.114 + 0.126) / (0.114 + 0.126 + 0.006 + 0.054) = 0.8

**1.e)**

P(pass | study) = (0.114 + 0.168) / (0.114 + 0.168 + 0.006 + 0.112) = 0.705

**2.a)**

P(B,I,M,G,J) = P(B) \* P(M) \* P(I | B,M) \* P(G | B,M,I) \* P(J | G)

**2.b)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | **B** | | | | | | | | | | | **¬B** | | | | | | | |
| **M** | | | | | **¬M** | | | | | **M** | | | | | | **¬M** | | |
| **I** | | **¬I** | | **I** | | | **¬I** | | **I** | | | | **¬I** | | **I** | | | **¬I** |
| **G** | **J** | 0.06561 | | 0 | | 0.29160 | | | 0 | | 0.0009 | | | | 0 | | 0.00081 | | | 0 | |
| **¬J** | 0.00729 | | 0 | | 0.03240 | | | 0 | | 0.0001 | | | | 0 | | 0.00009 | | | 0 | |
| **¬G** | **J** | 0 | | 0 | | 0 | | | 0 | | 0 | | | | 0 | | 0 | | | 0 | |
| **¬J** | 0.0081 | | 0.009 | | 0.081 | | | 0.405 | | 0.004 | | | | 0.005 | | 0.0081 | | | 0.081 | |

**2.c)**

P(J | B,I,M) = 0.06561 / (0.06561 + 0.00729 + 0.0081) = 0.81

**3.a)**

* ∀p,c,s person(p) ∧ car(c) ∧ near(p,c,s) ∧ has(p,key(c,s),s) ∧ (battery\_level(battery(c,s),s) != 0) ∧ (gas\_level(c,s) != 0) → possible(start(p,c,s),s)
  + battery\_level() could be checked against battery\_capacity() if we are interested in checking if fully charged.
* ∀p,c,s person(p) ∧ car(c) ∧ (start(p,c,s) ↔ running(c,p,result(start(p,c,s))))
* ∀p,c,s person(p) ∧ car(c) ∧ running(c,p,s) → located(p,c,s) ∧ has(p,key(c,s),s)

Frame Axiom:

* ∀p,c1,c2,k,s person(p) ∧ car(c1) ∧ car(c2) ∧ start(p,c1,s) ∧ (gas\_level(c2,s) = k) ∧ (c1 != c2) → (gas\_level(c2,result(start(p,c1,s))) = k)

**3.b)**

* ∀v,p,r,s vendor(v) ∧ product(p) ∧ person(r) ∧ owns(v,p,s) ∧ (moneyWith(r,s) >= cost(p,v,s)) → owns(r,p,result(buy(r,v,p,s))) ∧ (moneyWith(r,result(buy(r,v,p,s))) = moneyWith(r,s)-cost(p,v,s)) ∧ (moneyWith(v,result(buy(r,v,p,s))) = moneyWith(v,s)+cost(p,v,s))

Frame Axiom:

* ∀p1,p2,r1,r2,v,s vendor(v) ∧ person(r1) ∧ person(r2) ∧ product(p1) ∧ product(p2) ∧ (p1 != p2) ∧ (owner(p2,s)=r2) → (owner(p2,result(buy(r1,v,p1,s)))=r2)

**4.**

|  |  |
| --- | --- |
| **State(s) to be proved/regressed** | **Action performed** |
| on(A, C) | put(A, C) → A can be on C if it was put on C. |
| holding(A), clear(C) | pick(A, table) → to hold A, it should have been picked from somewhere. |
| clear(C), clear(A), GE, on(A, table) | put(C, B) → for C to be clear, it could have just been dropped off the Gripper. |
| clear(A), on(A, table), holding(C), clear(B) | pick(C, A) → to hold C, it should have been picked from somewhere & for A to be clear, block on top of A could have been removed. |
| on(A, table), clear(B), clear(C), GE, on(C, A) | → Subset of initial state, hence goal regression succeeds. |