Car Problems

a. P(Fuel = Yes | FM = Empty) = P(Fm=Empty | Fuel=Yes) * P(Fuel=Yes) / P(Fm = Empty) = 0.2* 0.6 / (P(Fm = Empty | Fuel=Yes)P(Fuel=Yes) + P(Fm = Empty | Fuel=No)P(Fuel=No) = 0.2 * 0.6 / (0.2*0.6+ 0.85*0.4) = 0.12 / 0.46

b. F(FM , Fuel, St, Sp) = P(FM | Fuel) * P (Fuel) * P(St | Fuel, SP) * P(SP)

c. P(Fuel = No, SP = Yes, FM = Half, St = No) = 0.4 * 0.8* 0.1 * 0.99

d. P(St=yes|Fm=Empty)=$\alpha\sum_{Fuel}\sum_{SP}\mathrm{P(FM|Fuel)} * \mathrm{P(Fuel)} * \mathrm{P(St|Fuel,SP)} * \mathrm{P(SP)}$ with α = 1/ P(Fm = Empty)
= { (P(fm=empty | fuel = yes)*P(fuel=yes)*P(st=yes|fuel=yes,sp=yes) * P(sp=yes))
+ (P(fm=empty | fuel = yes)*P(fuel=yes)*P(st=yes|fuel=yes,sp=no) * P(sp=no))
+ (P(fm=empty | fuel = no)*P(fuel=no)*P(st=yes|fuel=no,sp=yes) * P(sp=yes))
+ (P(fm=empty | fuel = no)*P(fuel=no)*P(st=yes|fuel=no,sp=no) * P(sp=no))} /
((P(Fm = Empty | Fuel=Yes)P(Fuel=Yes) + P(Fm = Empty | Fuel=No)P(Fuel=No))

= { 0.2 * 0.6* 0.95 * 0.8 + 0.2 * 0.6* 0.1*0.2 + 0.85 *0.4*0.01*0.8 + 0.85*0.4*0*0.2 } / (0.2*0.6+ 0.85*0.4)

Part a: 2pts for formula 1pt for numbers
Part b: 3 pts for the formula
Part c: 3 pts for the numbers
Part d: 4pts for formula and 2 pts for numbers. -1 for each error.

Lime or Lyft?

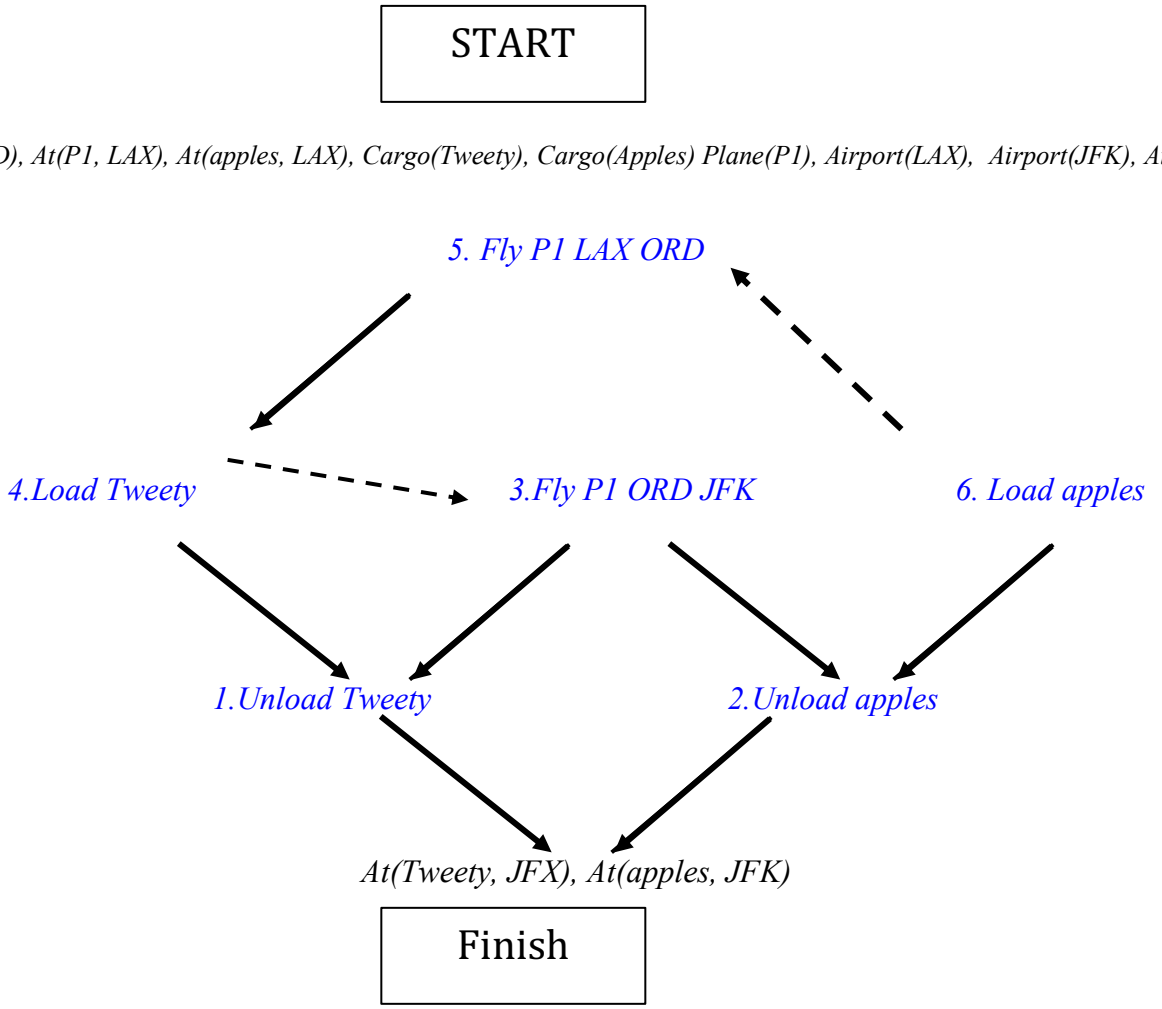
a. Remainder(Outlook) = 5/16 (-(3⁄5 log 3⁄5 + 2⁄5 log 2⁄5)) + 5/16 (0) + 6/16 (-(5⁄6 log 5⁄6 + 1⁄6 log 1⁄6)) Remainder(Humidity) = 1⁄2 (1) + 1⁄2 (0) => least remainder, highest information gain => root attribute

Remainder(Destination) = 9/16 (-(2/9 log 2/9 + 7/9 log 7/9)) + 7/16 (-(2/7 log 2/7 + 5/7 log 5/7))

[1pt for each correct expression of the remainder of an attribute, 3pts for determining the root attribute]

b. Lyft? = (HighHumidity ^ Sunny) ∨ (HighHumidity ^ Rainy ^ Far)
[2pts for each correct level of the tree, 3pts for the learned concept, no partial credit]

Cargo Shipping



+1 for correct Action 1-3 and correct causal links to satisfy an open goal
+4 for correct Action 4-6 w/correct causal link to an open goal/ordering constraints
-3 for extra/incorrect actions
-3 for extra/incorrect arrows

True/False

a.T b. F c. F d. T e. F f. F g.T h.F g.T h. F

Multiple choices

(+5pts each -1 for wrong or missing and 0 for none right)

a. 2

b. 2

c. ALL

Robot Maze

R4=128 and R6=98

4a

S1 32	S2 8	S3 24.5
S4	S5 24.5	S6

4b

$$128 * \gamma * \gamma * \gamma \geq 98 * \gamma$$
$$\gamma^2 \geq \frac{98}{128} = \frac{49}{64}$$
$$\gamma \geq \frac{7}{8}$$

Policy changes: S3->S2(Left), S5->S2(Up)

4c

S1 25.6	S2 5.12	S3 19.6
S4	S5 19.6	S6

Part a 3 pts: -1 for each error
Part b 4 pts: formula 3 pts and the final result(policy change) 1 pt
Part c 8 pts: -1 for each error

Monkey Meal

a) ∀ x,z ((Monkey(x) ∧ Snack(z)) ⇒ ∃ y,t (Food(y) ∧ Food(t) ∧ Eats(x,y,z) ∧ Eats(x,t,z) ∧ y≠t))

b) ∃ x (Monkey(x) ∧ Failed(x, Banana,Morning) ∧ ∀ y (Monkey(y) ∧ Failed(y, Banana,Morning) ⇒ x = y))

c) ¬ ∃ x (Monkey(x) ∧Failed(x, Mango,Morning)) ∧ ∃ y (Monkey(y) ∧ Failed(y, Banana,Morning))

d) ∀ x,z (Monkey(x) ∧ Eats(x, Mango,z) ⇒ Eats(x, Grapes,z))

e) ¬ ∃ x,z (Monkey(x) ∧ Eats(x, Grapes,z) ∧ Eats(x,Nuts,z))

+3pts each for logically equivalent answer