

CSci 166

Group Project Proposal

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(1,1) AT HOME WITH NO GROCERIES (START)

Actions: ???

Utility: ???

I need to go
shopping.

(11,1) MADE IT HOME WITH GROCERIES (END)

Actions: ???

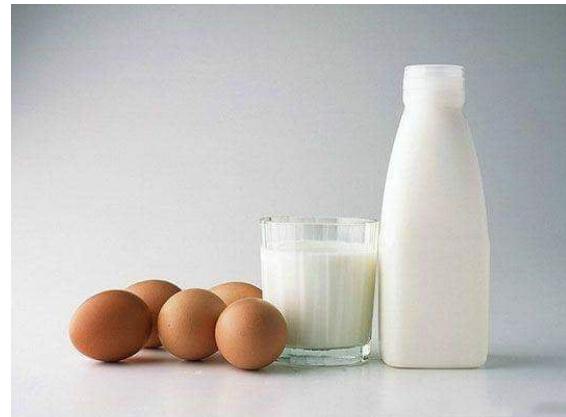
Utility: ???

Problem

- Were running low on groceries.
- What is on my list?
- I don't want to spend a lot of money.
- I don't have a lot of time.
- I don't want to visit a lot of stores, Costco, Walmart, Vallarta...
- Will I need to get gas?

Tyler Gillette

- Senior CSCI major at Fresno State.
- Full time Network Admin/ERP Programmer.
- The goal is to program large scale industrial applications.



BEING A PROGRAMMER

My mom said:
"Honey, please go to the market and buy 1 bottle of
milk. If they have eggs, bring 6"

I came back with 6 bottles of milk.

She said: "Why the hell did you buy 6 bottles of
milk?"

I said: "**BECAUSE THEY HAD EGGS!!!!**"

Part 1: Domain

Get all X items with the minimum owed balance on your credit card, gas in the vehicle and least amount of time spent.

There will be 21 states each with 1-2 possible actions, a reward and living reward, store and each with a possible exit.

Part 1: Domain

- Possible actions are going to different stores
 - Any state can take an action to purchase the rest of the items and go home.
- 85% chance the item is in stock, 15% chance it's not and must drive to costco to purchase the rest of the items there.
- Rewards are a combination of cost to purchase an item.
- There is a time cost for each action as living reward.
- You must purchase all X items to take an exit. (User Input) (exit when list is done or out of cash (huge - reward))
- The goal is to exit with the least amount of debt owed. (least \$ spent and finished list)
- Possible to stop for gas if required.

Eric Smrkovsky

- Junior in the computer science program at Fresno State.
- Want to work towards a PhD in computer science and go into teaching.
- Still trying to find out what area of computer science I want to specialize in.
- Current plan is to achieve masters at Fresno State.
- I consider AI a very interesting tool and look forward to understanding more about it.

Other People's Responses to the fact that I am a Computer Science Major



Part 2: Problem Representation

What could our shopping world look like? States?
Actions? Rewards?

- Start and end states are when we are at home.
- Actions bring us to different states.
- Living reward for each transition.
- Discounted rewards are possible.
- Bonus reward for being home.

(1,1) AT HOME WITH NO GROCERIES (START) Actions: Costco(R) / Store1(D) Utility: ???	(1,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(2,1) AT STORE1 BUYING ITEM Actions: Costco(R) / Store2(D) Utility: ???	(2,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(3,1) AT STORE2 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(3,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(4,1) AT STORE3 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(4,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(5,1) AT STORE4 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(5,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(6,1) AT STORE5 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(6,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(7,1) AT STORE6 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(7,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(8,1) AT STORE7 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(8,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(9,1) AT STORE8 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(9,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(10,1) AT STORE9 BUYING ITEM Actions: Costco(R) / Store3(D) Utility: ???	(10,2) AT STORE BUYING ITEMS Actions: ??? Utility: ???
(11,1) MADE IT HOME WITH GROCERIES (END) Actions: ??? Utility: ???	NOTE: Each transition includes a living reward!

We have a list of 9 items that we need to purchase and we are low on gas.

A possible world could be...

Some possible states:

- (At Home)
- (At Store# Buying Item X)
- (At Costco buying X Items)

Some possible actions:

- Going down brings us to a store for a single item.
- Going right brings us to Costco for multiple items.
- Going Home only occurs when we finish our shopping list and don't need gas.
- Getting Gas only happens after all items have been purchased.

(1,1) AT HOME WITH NO GROCERIES (START) Actions: Costco(R) / Store1(D) Reward: ???	(1,2) AT COSTCO BUYING 9 ITEMS Actions: Go Home / Get Gas Reward: ???
(2,1) AT STORE1 BUYING ITEM Actions: Costco(R) / Store2(D) Reward: ???	(2,2) AT COSTCO BUYING 8 ITEMS Actions: Go Home / Get Gas Reward: ???
(3,1) AT STORE2 BUYING ITEM Actions: Costco(R) / Store3(D) Reward: ???	(3,2) AT COSTCO BUYING 7 ITEMS Actions: Go Home / Get Gas Reward: ???
(4,1) AT STORE3 BUYING ITEM Actions: Costco(R) / Store4(D) Reward: ???	(4,2) AT COSTCO BUYING 6 ITEMS Actions: Go Home / Get Gas Reward: ???
(5,1) AT STORE4 BUYING ITEM Actions: Costco(R) / Store5(D) Reward: ???	(5,2) AT COSTCO BUYING 5 ITEMS Actions: Go Home / Get Gas Reward: ???
(6,1) AT STORE5 BUYING ITEM Actions: Costco(R) / Store6(D) Reward: ???	(6,2) AT COSTCO BUYING 4 ITEMS Actions: Go Home / Get Gas Reward: ???
(7,1) AT STORE6 BUYING ITEM Actions: Costco(R) / Store7(D) Reward: ???	(7,2) AT COSTCO BUYING 3 ITEMS Actions: Go Home / Get Gas Reward: ???
(8,1) AT STORE7 BUYING ITEM Actions: Costco(R) / Store8(D) Reward: ???	(8,2) AT COSTCO BUYING 2 ITEMS Actions: Go Home / Get Gas Reward: ???
(9,1) AT STORE8 BUYING ITEM Actions: Costco(R) / Store9(D) Reward: ???	(9,2) AT COSTCO BUYING 1 ITEM Actions: Go Home / Get Gas Reward: ???
(10,1) AT STORE9 BUYING LAST ITEM Actions: Costco(R) / Go Home / Get Gas Reward: ???	(10,2) STOP FOR GAS Actions: Go Home Reward: ???
(11,1) MADE IT HOME WITH GROCERIES (END) Actions: None Reward: ???	NOTE: Each transition includes a living reward! If an item is sold out at StoreX we are forced to go to Costco.

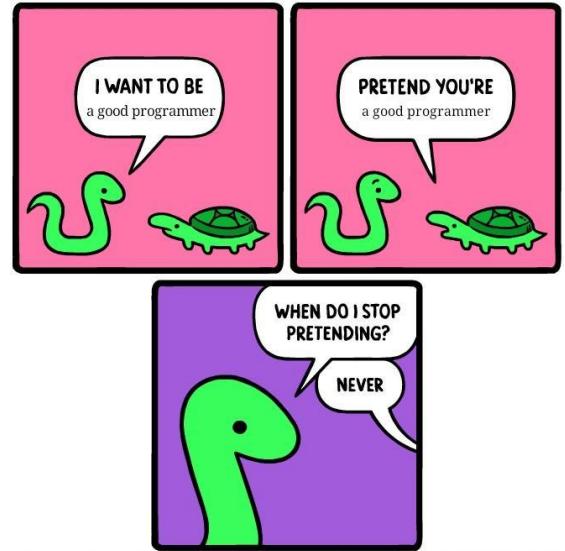
What is involved with each transition between stores?

Every transition comes with a living reward and a reward for being in that state.

(1,1) AT HOME WITH NO GROCERIES (START) Actions: Costco(R) / Store1(D) Reward: 0	(1,2) AT COSTCO BUYING 9 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(2,1) AT STORE1 BUYING ITEM Actions: Costco(R) / Store2(D) Reward: Cost + Variables = ?	(2,2) AT COSTCO BUYING 8 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(3,1) AT STORE2 BUYING ITEM Actions: Costco(R) / Store3(D) Reward: Cost + Variables = ?	(3,2) AT COSTCO BUYING 7 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(4,1) AT STORE3 BUYING ITEM Actions: Costco(R) / Store4(D) Reward: Cost + Variables = ?	(4,2) AT COSTCO BUYING 6 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(5,1) AT STORE4 BUYING ITEM Actions: Costco(R) / Store5(D) Reward: Cost + Variables = ?	(5,2) AT COSTCO BUYING 5 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(6,1) AT STORE5 BUYING ITEM Actions: Costco(R) / Store6(D) Reward: Cost + Variables = ?	(6,2) AT COSTCO BUYING 4 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
(7,1) AT STORE6 BUYING ITEM Actions: Costco(R) / Store7(D) Reward: Cost + Variables = ?	(7,2) AT COSTCO BUYING 3 ITEMS Actions: Go Home / Get Gas Reward: Cost + Variables = ?
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(10,1) AT STORE9 BUYING LAST ITEM Actions: Costco(R) / Go Home / Get Gas Reward: Cost + Variables = ?	(10,2) STOP FOR GAS Actions: Go Home Reward: Cost + Variables = ?
(11,1) MADE IT HOME WITH GROCERIES (END) Actions: None Reward: Stress minimized = BONUS REWARD!	NOTE: Each transition includes a living reward! If an item is sold out at StoreX we are forced to go to Costco.

Vincent Weinberger

- Senior CSCI Major at Fresno State
- Interested in Web Development
- AI seems to be growing A LOT and I can see myself implementing a lot of these practices in my career at some point in the future.



THIS COMIC MADE POSSIBLE THANKS TO OWEN LOPEZ

@MrLovenstein • MRLOVENSTEIN.COM

Transitions & Rewards

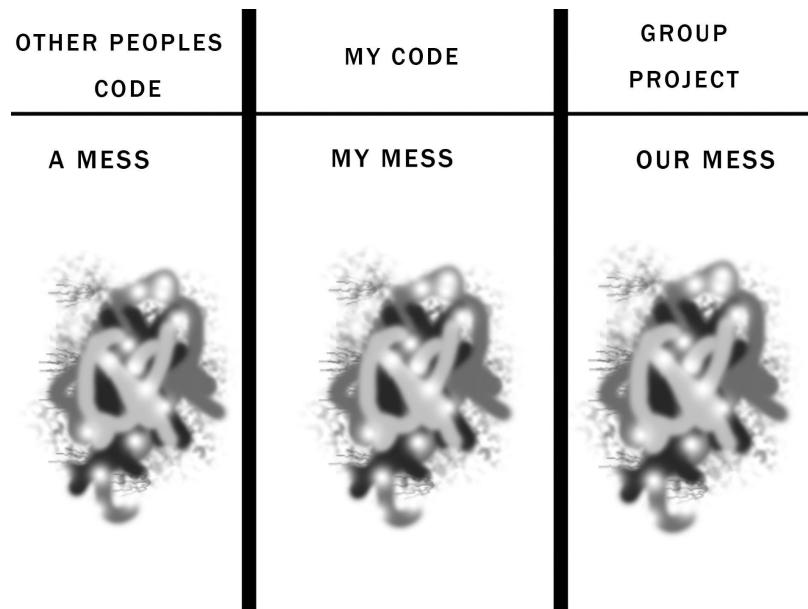
- Transitions in this model will all have a cost for one reason or another. Gas, Stress, and Time will all be variables to take into account when we consider driving to a another store:
 - Gas costs money.
 - A person's Stress or mental fortitude must be taken into consideration if they are to go shopping for lengthy periods of time at a multitude of different stores.
 - People have Time constraints when it comes to performing tasks in their daily lives.
- Another facet of our transitions would have to be the probability. Our agent may have a probability of forgetting an item on the shopping list and therefore will have to stay in the same state and revisit the store to buy the item.
- There will be no positive rewards in this model. As in the real world, going shopping will only cost you money and you will not achieve any net positive gains. You can only try to mitigate your losses.

Part 3: MDP Exploration

- We could go with a model where we know all the prices of each item at every store. This would fit the modern day approach to shopping where one can look up an item online and see where it is cheapest. This would lead us down the road of implementing Value Iteration for our model and then Policy Extraction & Evaluation.
- If we do not have the luxury of knowing all the item prices, then we may have to take the approach of reinforcement learning.

Michael

- Senior at Fresno State
- Goal is to find out what makes the science in computer science



Part 4: RL Exploration

We plan on using value iteration with Reinforcement Learning to go through the grid. We would implement mpd with the possibility of using Q-Learning to help. If Q-Learning is used, then we need to come up with possible features for the Q-function to apply to the weights.

What features will be present?

- If we used Q-learning where we don't know the rewards of a state:
 - Distance from something like a mugger and update the weights of the store
 - Same for if money is found at a store and update the weights
 - Number of stores in relation to muggings that have happened that store
 - The stress from being at a costco or a regular store
 - Distance from one store to another
 - $1/(distance \text{ to shopping item})^2$

Monica

- Senior
- Former VISA Software Engineer Intern
- Interests - UI/Front End



Part 5: Experiments

- Outline the set of experiments you plan to use to evaluate your system.

Data set with grocery list (about 20-25 items) that the shopper would need buy at 10 different stores each with different prices

Probability - 85% that item is in stock and 15% isn't in stock

Have episodes and learn prices at the different store and will go to the cheaper ones but there's a 15% chance it isn't in stock and will go to a different store