# Stock Transaction Game

# **Group Members**

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## Link to the github repository

https://github.com/rjiang1/StockTrade.git

## **Game Rules**

## **States**

The state of the game at each turn is players current portfolio that consists of company name, number of shares of that company owned by player, player's current cash balance and the current day's information of the stock AAPL.

In addition, stock information includes

- ➤ High The highest price the stock traded for that day
- ➤ Low The lowest price the stock traded for that day
- Close The final price of the stock that day
- ➤ Volume The amount of stocks everyone trades in the stock market on that day
- ➤ 20\_day The average price of the stock over the course of the last 20 days
- > 50 day The average price of the stock over the course of the last 50 days

# **State Representation**

The player states are represented as class Player which has attributes portfolio and cash.

The portfolio is stored by dictionary i.e. {companyName: # of shares} and current cash balance is stored in a variable.

The stock states are represented as class Stock which has attributes ticker and price.

# **Valid Actions**

- Buy Enter B/b to buy a stock and then the player has to enter number of stocks he/she want to buy, one cannot buy stock worth more than his/her cash balance.
- Sell Enter S/s to sell a stock and then the player have to enter number of stocks he/she want to sell, one cannot sell stocks whose count is more than what he/she actually owns.
- Do Nothing/ Hold Enter H/h, the player will be shown next day apple stock.
- Exit Enter E/e the player will be exited out of prediction game and his/her portfolio, profit/ loss will be shown.

#### Game Over

The game is over after the n days player's prediction(n is what the player gave as input at first) or when the player enters the action Exit.

## Winner/score Determined

TotalCash will be calculated as cash Balance + total shares cost that one holds according to n+1 day apple stock open price. And the player ends up in profit [win] i.e., totalCash > 10000 (starting balance) or loss i.e., totalCash < 10000.

## **Problem extension**

We varied the size of the problem instance in our experiments by letting the player set the number of days he/she wants to predict the stock transaction. For the actions, we have added an exit action in the first version of the experiment, which allows players to exit the game at any time.

As of now, we implemented this game as a single player game because AI part isn't implemented yet. However for the different numbers of players, we prepared to extend the problem to two, three players or more players. The several players all predict according to the same stocks' information and the player who ends up in the highest profit win the game. For the different numbers of stocks, we can add more stocks' information except AAPL, like GOOG, MSFT, etc in the future. Then when the players do the buy, sell or hold action, players need to not only set the number of shares but also choose which stock to trade.

# **Language and Libraries**

Python, numpy, pandas, pytorch/tensorflow/keras

# **Example**

How many days of stock you w Day 2 apple stock: Open-->12 ant to predict?5 6.012497 Player your Shares : {'Appl e': 0} your Cash: 10000 High-->126.442497 Day 1 apple stock: Open-->12 7.14250200000001 Low-->124.577499 Close-->124.807503 High-->127.485001 Volume-->187630000.0 Low-->123.832497 4 things you can do Close-->125.010002 Buy(B/b)
 Sell(S/s)
 Hold(H/h)
 Exit(E/e) Volume-->155552400.0 what you want to do?!!!! 4 things you can do Buy(B/b)
 Sell(S/s)
 Hold(H/h)
 Exit(E/e) Player your Shares : {'Appl e': 0} your Cash: 10000 what you want to do?!!!! Day 3 apple stock: Open-->12 7.58000200000001 How many shares you want to sell--> 5 Sorry you dont own that many High-->131.0 stocks, Try again!!! Low-->126.0 Player your Shares : {'Appl e': 0} your Cash: 10000 Close-->129.0399929999998 Day 1 apple stock: Open-->12 Volume-->225702700.0 7.14250200000001 4 things you can do High-->127.485001 Buy(B/b)
 Sell(S/s)
 Hold(H/h)
 Exit(E/e) Low-->123.832497 what you want to do?!!!! Close-->125.010002 Player your Shares : {'Appl Volume-->155552400.0 e': 0} your Cash: 10000 4 things you can do Day 4 apple stock: Open-->13 1. Buy(B/b) 2. Sell(S/s) 3. Hold(H/h) 4. Exit(E/e) 2.759995 High-->134.800003 what you want to do?!!!! Low-->130.529999 How many shares you want to buy--> 100 Close-->134.179993 Sorry you cant afford that m any stocks, Try again!!! Volume-->152470100.0 Player your Shares : {'Appl e': 0} your Cash: 10000 4 things you can do 1. Buy(B/b) 2. Sell(S/s) 3. Hold(H/h) 4. Exit(E/e) Day 1 apple stock: Open-->12 7.14250200000001 what you want to do?!!!! High-->127.485001 How many shares you want to buy--> 2 Low-->123.832497 Player your Shares : {'Appl e': 2} your Cash: 9734.48001 Close-->125.010002 Day 5 apple stock: Open-->13 Volume-->155552400.0 7.5899959999999 4 things you can do 1. Buy(B/b) 2. Sell(S/s) 3.
Hold(H/h) 4. Exit(E/e) High-->137.979996 Low-->127.0 what you want to do?!!!! Close-->131.399994 Player your Shares : {'Appl e': 0} your Cash: 10000 Volume-->200119000.0

4 things you can do
1. Buy(B/b) 2. Sell(S/s) 3. Hold(H/h) 4. Exit(E/e) what you want to do?!!!! How many shares you want to sell--> 2 Player your shares : {'Appl e': 0} your cash :10009.6600 01999999 shares cost : 0.0 Congrats! you made profit o f:9.660001999998713 Game end 000000000000000 <><><><> Want to play again!! Enter Y/y or N/n: y How many days of stock you w ant to predict?3 Player your Shares : {'Appl e': 0} your Cash: 10000 Day 1 apple stock: Open-->12 7.14250200000001 High-->127.485001 Low-->123.832497 Close-->125.010002 Volume-->155552400.0 4 things you can do
1. Buy(B/b) 2. Sell(S/s) 3. Hold(H/h) 4. Exit(E/e) what you want to do?!!!! How many shares you want to buv--> 1 Player your Shares : {'Appl e': 1} your Cash: 9872.85749 Day 2 apple stock: Open-->12 High-->126.442497 Low-->124.577499 Close-->124.807503 Volume-->187630000.0 4 things you can do 1. Buy(B/b) 2. Sell(S/s) 3. Hold(H/h) 4. Exit(E/e)what you want to do?!!!! Player your shares : {'Appl e': 1} your cash :9872.85749 8 shares cost : 126.012497 Oh No! you lost :1.130005000 0008923 Game end <><><><><> <><><> Want to play again!! Enter

Y/y or N/n: n

Thanks For Playing Game!!

#### Game 1:

Wanted to predict 5 days of the stock transaction. Displaying the initial values of player portfolio and cash as 10000.

## **Day 1:**

Tried sell action, the player tried to sell stocks more than what he/she owns, so Failed.

Tried buy 100 shares action, the player tried to buy stocks worth more than his/her current balance, so Failed.

Tried hold action, Returned shares: {'Apple': 0} cash: 10000.

# **Day 2:**

Tried hold action, Returned shares: {'Apple': 0} cash: 10000.

## Day 3:

Tried hold action, Returned shares: {'Apple': 0} cash: 10000.

# **Day 4:**

Tried buy 2 shares action,

Returned shares: {'Apple': 2} cash: 9734.48001.

## **Day 5:**

Tried sell 2 shares action, Returned shares : {'Apple': 0} cash :10009.660001999999 shares cost : 0.0.

# The player won the game and made profit of:

9.660001999998713.

Game was over.

## Game 2:

Wanted to predict 3 days of the stock transaction. Displaying the initial values of player portfolio and cash as 10000.

## Day 1:

Tried buy 1 share action,

Returned shares: {'Apple': 1} cash: 9872.857498.

# **Day 2:**

Tried exit action, Returned shares: {'Apple': 1} cash: 9872.857498 shares cost: 126.012497.

The player lost the game and lost: 1.1300050000008923.

Game was over.