LAB 03 : MONOPOLY DESIGN

Due Saturday at 5:00 PM MST

This week, we will create a design for a program representing a "complex" decision. Specifically, our program will determine whether a Monopoly player can build a hotel on a given property.

Program Description

Monopoly is a board game that traces its roots to 1903 and still widely played today. An important part of the game is the process of developing properties. For example, if a player is able to put a hotel on a property, that player can charge more rent to other players who land on that space. The question remains: under what circumstances can a player place a hotel on his or her property? We will write a program to make that determination.

Write a program that will ask the user a series of questions and determine whether the player can place a hotel on Pennsylvania Avenue. For the purposes of this problem, we are not including the logic to purchase a given property. As a point of reference, the official rules of Monopoly are found here. The most important rules for this lab are the following:

1. Each house on Pennsylvania Avenue, Pacific Avenue, and North Carolina Avenue costs $200.

2. The properties in a color group must be developed evenly, i.e. each house that is built must go on a property in the group with the fewest number of houses on it so far.

3. To purchase a hotel for Pennsylvania Avenue, Pacific Avenue, or North Carolina Avenue, one must first have four houses and then pay the bank an additional $200.

4. There can be no more than four houses and no more than one hotel per property. A property cannot have both hotels and houses.

5. A hotel may be built on a color group only after all properties in the group have four houses. A player purchases a hotel by paying the price of an additional house, and returning the four houses on that property to the Bank in exchange for a hotel.

6. When the Bank has no houses to sell, players wishing to build must wait for some player to return or sell his/her houses to the Bank before building. If there are a limited number of houses and hotels available and two or more players wish to buy more than the Bank has, the houses or hotels must be sold at auction to the highest bidder. **NOTE:** Though auctioning is part of the Monopoly game, we will not include auction logic in this assignment.

7. If a player wishes to buy a house/hotel for a property, it is not necessary to wait for their turn. The player can buy houses/hotels even if it is not their turn. The player does not need to be on the property they wish to put the house/hotel on.

8. A player may swap the houses/hotels on the property within a color group on the player's turn without cost.

9. All the properties in a color group must be owned by a single player before a hotel is built.

For this assignment, our job is to create a flowchart representing the decision process of whether a player can put a hotel on Pennsylvania Avenue. This happens at the beginning of the player's turn. The program will then recommend the least-expensive path to do so.

Hints:

- Make sure you check that the player has enough funds to build the hotel. You may prompt the user to see how much money he or she as to spend on property improvements.
- There should be between a half dozen and a dozen decision diamonds. If you only have a couple, then you are probably missing several cases.
- Remember, we are not including the logic to purchase a property.
- You purchase houses when another player sells his/her houses to the bank. This does not happen at the beginning of your turn in this simulation.
- The rules say that you must put houses on a property before purchasing a hotel. For example, consider the situation where there are no houses or hotels on the three properties. If there are no available houses and three hotels in the bank, we cannot purchase a hotel because each property needs to have four houses first.
- It might be easier to read if you break the large flowchart into smaller, more managable chunks. This can be done with connectors.

Prompts

Please use the following prompts:

Prompt: PC

```
What is on Pacific Avenue? (0:nothing, 1:one house, ... 5:a hotel)
```

Prompt: NC

```
What is on North Carolina Avenue? (0:nothing, 1:one house, ... 5:a hotel)
```

Prompt: PA

```
What is on Pennsylvania Avenue? (0:nothing, 1:one house, ... 5:a hotel)
```

Prompt: Cash

```
How much cash do you have to spend?
```

Prompt: Houses

```
How many houses are there to purchase?
```

Prompt: Hotels

```
How many hotels are there to purchase?
```

Prompt: Color Group

```
Do you own all the green properties? (y/n)
```

Make sure your flowchart contains all these prompts and no others.

Output

When finished, the algorithm will display one of the following messages:

Out: Cash

```
You do not have sufficient funds to purchase a hotel at this time.
```

Out: No Houses

```
There are not enough houses available for purchase at this time.
```

Out: No Hotels

```
There are not enough hotels available for purchase at this time.
```

Out: No Properties

```
You cannot purchase a hotel until you own
        all the properties of a given color group.
```

Out: One Hotel

```
You cannot purchase a hotel if the property already has one.
```

Out: Swap NC

```
Swap North Carolina's hotel with Pennsylvania's 4 houses.
```

Out: Swap PC

```
Swap Pacific's hotel with Pennsylvania's 4 houses.
```

Out: Purchase A

```
This will cost $[price].
Purchase 1 hotel and [number of houses] house(s).
Put 1 hotel on Pennsylvania and return any houses to the bank.
Put [number of houses] house(s) on North Carolina.
Put [number of houses] house(s) on Pacific.
```

Out: Purchase B

```
This will cost $[price].
Purchase 1 hotel and [number of houses] house(s).
Put 1 hotel on Pennsylvania and return any houses to the bank.
Put [number of houses] house(s) on North Carolina.
```

Out: Purchase C

```
This will cost $[price].
Purchase 1 hotel and [number of houses] house(s).
Put 1 hotel on Pennsylvania and return any houses to the bank.
Put [number of houses] house(s) on Pacific.
```

Out: Purchase D

```
This will cost $[price].
Purchase 1 hotel and [number of houses] house(s).
Put 1 hotel on Pennsylvania and return any houses to the bank.
```

Assignment

To submit this assignment, one thing is needed: a flowchart. This will be submitted through I-Learn as a **single-file PDF**. You may want to use more than one page with a connector if you feel that makes it easier to read. It is OK to hand-draw the flowchart, take a picture of it with your phone, and put that picture in the PDF. Please make sure that it is readable. Notice the grading requirements for Professionalism.

In the last two weeks, you put a link to your demonstration video in the "Comments..." part of the "File Upload" feature. Please use that "Comments..." field to answer the following questions:

- How long did it take for you to create this flowchart?

- What was the hardest part of the assignment?

- Was there anything unclear about the instructions or how you were to complete this lab?

Assessment

Your grade for this activity will be according to the following rubric:

	Exceptional 100%	Good 90%	Acceptable 70%	Developing 50%	Missing 0%
Flowchart Format 30%	All of the flowchart symbols are used correctly	There is one minor discrepancy	At least two elements are used correctly but at least two elements are not used correctly	One or two elements resemble a flowchart	Flowchart is missing or the attached document does not contain anything looking like a flowchart
Design Quality 50%	Correct and the most elegant solution is found	The design completely covers the problem definition	One aspect of the problem definition is missing or one aspect of the design will not work as expected	Elements of the solution are present	Flowchart is missing or the provided solution does not resemble the problem definition
Professionalism 20%	Professional, beautiful, elegant	Everything is clear and legible	Misspelling, smudge, or examples of unprofessionalism	At least one aspect of the design is too messy to read	Difficult or impossible to read