Homework 3 – OO Programming Exercise

Problem Domain: Hardware Rental Store

- For this homework, you will design an object-oriented program to model the following problem domain.
- A hardware rental store has a catalog of 20 different tools to rent, spread across 5 different categories (Painting, Concrete, Plumbing, Woodwork, Yardwork). Each tool has a unique name (e.g. “Paint Tool 1”) and belongs to a specific category; the price per day to rent a tool varies by category. You may decide on the pricing of the rental categories.
- Customers are allowed to rent a tool for up to 7 nights. (Thus a tool rented for 7 nights on a Monday must be returned by the following Monday. A tool rented for "one day" would, for example, be rented on a Tuesday and returned the next morning before the rental store opens for business on Wednesday.) Customers are allowed to have at most three tools rented at any one time.
- This store has 10 customers; each customer has a unique name and is associated with one of three types. **Casual** customers rent one or two tools for one or two nights. **Business** customers always rent three tools for seven nights. **Regular** customers will rent one to three tools each time they visit for 3 to 5 nights.
- Each time a customer comes into the store, a Rental is created that will keep track of what tools they rented and how many nights they will keep the tools. A customer rents the "group" of tools and returns them all at the same time. They will NOT, for example, rent three tools and then return one after 2 days, the second after 5 days, and the third after seven days. They will instead return all of the tools they rented at the specified time. (That means, for instance, that a customer will never be late in returning their tools.)
- The store keeps track of the existing rentals along with the current inventory of the store. As such, when it has zero rentals, there will be 20 tools in its inventory. When it has zero tools in its inventory, it will have multiple rentals that between them account for all 20 tools.
- Finally, a customer pays up front for their rental. If, for example, a customer rents three Paint tools for three nights at a price of $3 per night, they will pay the store $27 dollars before they leave the store with their three tools.

Assignment

Write an object-oriented program that implements the problem domain and does the following:

- Simulates the activity of the rental store for 35 days (34 nights). On each day, a random number of customers will visit the store as long as there are tools to rent. Each customer will create one Rental that follows the rules of their associated type before they leave the store. That is, no customer will show up and then leave without making a rental. Note: if the store has less than 3 tools, then a Business customer will NOT arrive (as they wouldn't be able to create a Rental that follows their rules). As soon as the store has zero tools, customers will magically stop arriving until tools are once again available.
- At the end of the simulation, the program will produce a report that includes the following information:
    - the number of tools currently in the store along with a list of their names
    - the amount of money the store made during the 35 days (including any rentals that occurred on the 35th day)
    - a list of all the completed rentals including which tools were rented by which customer for how many days along with the total amount of that rental
    - a list of all the active rentals that includes all of the information listed in the previous bullet
- A customer can have more than one active rental. That is, they can show up on day 1 and rent 1 tool for 5 nights. They can then show up on day 2 and rent another tool for 4 nights. As long as they do not have more than 3 tools rented, they are allowed to have multiple rentals.
- Returns occur at the beginning of the day before the store opens for business. A tool rented for one night is available to customers the very next day; that's because the customer rented the tools for one night, used it, and got it back to the store early the next morning.
- Your program should be single-threaded; you do not need to handle the case of multiple customers trying to rent tools concurrently.

Other

- The purpose of this assignment is NOT to meet the requirements by any means necessary. A program that does the simulation above and produces the requested report but makes use of structured programming techniques (i.e. no objects, just data structures and a main program) will receive zero points (for the whole assignment).
- An object-oriented program that meets the requirements but doesn't make use of polymorphism, has poor abstractions, and poor encapsulation will lose many of the 30 points allocated to the program.
- Only object-oriented programs that show good use of abstraction, encapsulation and polymorphism and meet the above requirements will be able to get full credit for the program.
- Note in your documentation if any OO patterns are applied.
- 50 Point Submission is in two parts:
    - 30 Points - GitHub URL with

        - running, commented OO code (language of your choice) and
        - a README Markdown file with the names of team members and any special instructions to run the code (graders may request demonstrations)
    - 20 Points - PDF containing
        - Names of team members
        - Text description of program design
        - UML Class diagram that shows classes and relationships from your design (include data attributes and methods in the class diagram)
- Due Friday 3/1 11 AM (2 weeks)