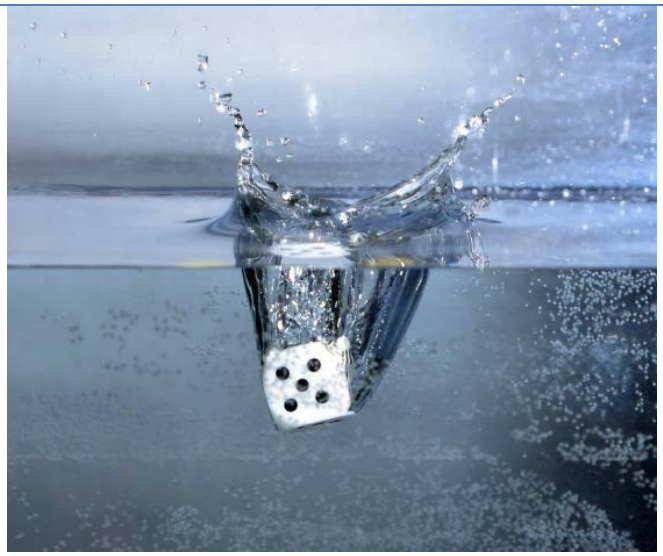
CPSC 2720 ~ 2018/2019

Dice on the High Seas



Team Nyreen

Team

Nicole Wilson and Dame Nutquacker

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INTRODUCTION

Nicole's purpose in taking on this project is three-fold:

I. To develop useful example material.

II. To gain greater mastery of tools used to complete the projects, namely: Code::Blocks, GitLab (using continuous integration), Valgrind, Lcov/Gcov, CppLint, and googletest.

III. To gain a better understanding of the students experience in this course in order to help develop better lab material and exercises.

Dice on the High Seas is software that will implement three dice games, Yacht, Love Boat, and Jolly Roger.

1. YACHT (the commercial version of this game is called Yahtzee)
   One to six participants play this game with five six-sided dice, each labelled one to six. Players attempt to match certain patterns and score points. The player with the highest points at the end of the game wins.

   a. Player turn, involves several actions taken in the following order:
      Action 1: Roll all five dice.
      Action 2: Either score your roll and end your turn or decide which dice of all five dice to place in the do not reroll pool and which to place in the reroll pool.
      Action 3: Reroll the dice in the reroll pool.
      Action 4: Either score your roll and end your turn or decide which dice of all five dice to place in the do not reroll pool and which to place in the reroll pool.
      Action 5: Reroll the dice in the reroll pool.
      Action 6: Choose an unused score pattern and record the score earned.

   b. Scoring
      There are thirteen score patterns that are divided into two categories.
      In the upper section you can earn points for the number of ones, twos, threes, fours, fives, or sixes in the roll. The player scores the sum of the dice that match the desired value. If the total of the upper section is at least 63 points you receive a bonus score of 35 points.
      In the lower section you can earn points for 3 of a kind (points earned equals the sum of all five dice), 4 of a kind (points earned equals the sum of all five dice), full house (25 points), a sequence of four (30 points), a sequence of 5 (40points), chance – any set of rolls (points earned equals the sum of all five dice), and Yahtzee – five of a kind (50 points).
      Every Yahtzee beyond the first, regardless of where it is scored, earns a bonus of 100 points.

   c. Notes:

      - Each player MUST record a score on their turn. If their dice do not match the requirements for the chosen score category, then the player scores 0 points.
      - Dice set aside before the second roll may be returned to the reroll pool for the third roll.
      - The game ends when all players have a score for every pattern.

2. LOVE BOAT

One to four participants play this game with six ten-sided dice, each labelled one to ten. Players attempt to match certain patterns and score points. The player with the highest points at the end of the game wins.

a. Player turn, involves two phases, the rolling and scoring phases:
   - In the rolling phase
     ~ First, you roll all the dice in the unlocked pool
     ~ Next, you choose which dice to move to the locked pool. (You cannot move dice out of the locked pool for the remainder of your turn)
     ~ This phase ends when there are no longer any dice in the unlocked pool or you have rolled the unlocked pool four times.
   - In the scoring phase
     ~ Choose one of the unused score patterns and record your score.

b. Scoring

   There are twenty-one score patterns that are divided into three categories.

   In the Promenade deck you can earn points for the number of ones, twos, threes, fours, fives, sixes, sevens, eights, nines, or tens in the roll. The player scores the sum of the dice that match the desired value. If the total of the Promenade deck is at least 165 points then you receive a bonus score of 100 points.

   In the Lido deck the points you earn correspond to the sum of all the dice for the patterns in captain's table (any combination of rolls), two pairs, full house, three of a kind, four of a kind, five of a kind or six of a kind. If the total for the Lido deck is at least 150 points then you receive a bonus score of 100 points.

   In the Gala deck the points you can earn points for getting a small, medium or large straight, that is a sequence of four, five, or six dice, is 90, 105, and 120 respectively. You can also score 100 for getting a skip sequence (1, 3, 5, 7; 2, 4, 6, 8; 3, 5, 7, 9; or 4, 6, 8, 10).

c. Notes:
   - Each player MUST record a score on their turn. If their dice do not match the requirements for the chosen score category, then the player scores 0 points.
   - The game ends when all players have a score for every pattern.

3. JOLLY ROGER

Four participants can play this game with five pools of dice each of which contains fifteen six-sided dice labelled with a subset of values from one to ten. Each player has access to the dice in the sea (the central die pool) and the beach on either side of them (the die pool between them and the players that proceed and follow them). The die pools between the players are called the north beach, east beach, south beach, and west beach.

a. To start the game, each player rolls a beach (one die pool) and places it on their right. The sea (the central die pool) is rolled and placed in the middle of the table.
b. On their turn each player may perform any two of the following actions, they cannot perform the same action twice:
   - Trade all the dice from the beach on their right or the beach on their left with all the dice in the sea (without rerolling them.)
   - Roll all the dice in the beach to their left, the beach to their right or the sea.

- Take three dice from the beach on their left, the beach on their right, or the sea and put them in their ship's hold (all three dice must come from the same place).
- Reroll all the dice showing a particular value on all beaches and in the sea (e.g.: Reroll all dice with a fours on top).

c. The game ends as soon as someone reaches 250 points.
d. A round ends when as soon as one of the beaches is empty.
   - Players tally their points, check to see if anyone has won the game, and if not set up for the next round.
e. Scoring
   - Each player arranges the dice in their hold into sets and sequences.
     ~ A set is at least three dice with the same number.
     Sum all the dice in a set to obtain the set score.
     ~ A sequence is at least three dice that form a sequence counting by ones, twos or threes.
     Multiply the number of dice in the sequence by 4 to obtain the sequence score.
     ~ There are two types of special sequences:
     → square sequence: 1, 4, 9 which is worth 24 points.
     → prime sequence:
     2, 3, 4 or 3, 4, 7 is worth 36 points and
     2, 3, 4, 7 is worth 48 points.
   - Each die may only be in one set or sequence.
   - Add the set and sequence scores then subtract the sum of the unused dice in your hold to get the score for the round.

Since these are all die games with a score card they have many elements in common. We plan to take advantage of that in the distribution of tasks and design by prioritizing the development of the sections of code and classes that will be used by all three games.

<Preview of rest of document> The rest of the document proceeds as follows. First, how the development of the project will be managed is described. Next, the development process our team will follow is presented. Finally, the initial design of our project is given.

PROJECT MANAGEMENT

TEAM ORGANIZATION

Nicole Wilson: Team Lead, Design Lead, Quality Assurance Lead, Documentation Lead, Software Developer, Software Tester

Dame Nutḍuacker: Laconic Inscrutable Mysterious Figure of Rumor and Legend

Ancillary Personnel
- Dr. Anvik: Pedagogical Advisor
- Duckbill: Alpha Tester

RISK MANAGEMENT

1. REQUIREMENTS/DESIGN/ESTIMATION

We have prioritized the list of classes to be developed. The classes required for all the games will be written first then the classes for Yacht will be written so that at least one game will be completed. Should the planned project turn out to be too ambitious or our time estimates too optimistic then we will abandon Jolly Roger and/or Love Boat.

The team leader will assign each team member specific tasks, keeping the strengths, preferences, and schedules in mind. Deadlines to complete their tasks will be established at the weekly team meetings. In this way we hope to realize as early as possible if a section of the project is falling behind.

If we discover major changes to our design are required during implementation then we will concentrate on implementing Yacht and abandon development of generalized classes in favor of classes for Yacht. For example instead of trying to find the best score for a particular roll the AI will simply roll and reroll dice at random then score the next item in the score list in each turn.

2. PEOPLE

If this team had multiple human members then we would use the prioritized development lists mentioned above to reduce the work load if a team member quits or becomes unavailable due to a major life event or unexpected commitment.

If a team member lacks expected technical skills, in the short term, they will be assigned to less technical tasks and that member will be asked to shadow another member of the team to gain technical skills.

If a team member is not meeting deadlines then the team leader will speak to them individually to determine why this has happened. If there is no particular reason and the behaviour doesn't change it will be addressed in a team meeting. If that member's section of the project preventing others from completing their work or is more than a week behind then that individual's responsibilities will be reassigned. If the member fails to meet deadlines a three times or if the group is unable to contact the member then the rest of the team will meet with Dr. Anvik and let him know that we will no longer assign tasks to this member.

Since this group actually has only one human member we must recognize that Nicole is taking on an awful lot. If she bows out of the project not much will get done (this project's faux waterfowl are not really self starters, at least in relation to software development). The only way to manage this risk is to recruit additional team members. Apparently, Nicole's half-hearted sales pitch was ineffective. In other words, that has not been a successful endeavour.

If the not so feathered members of the team bow out they will be missed for their moral support but it should not affect the ability of the team to complete the project.

3. LEARNING & TOOLS

If this team had multiple human members then we would manage unfamiliar tools in the following manner. Before choosing a tool not taught in the labs/class nor recommended by Dr. Anvik an assessor will be chosen to do a quick study of the advantages and disadvantages of using the tool, they will also be responsible for teaching the basics of the tools use to the rest of the team if they decide to recommend the tool. If the tool is one taught in the lab that we do not have sufficient mastery to use we will make an appointment with the lab instructor to ask

for help. If the tools we have chosen do not work together we will meet to decide which tool to keep using and assign a member to assess other options for the other tool.
Since this group actually has only one human member, everything depends on her abilities. However, one of the goals for undertaking this project is to learn to use new tools hence the only appropriate response to problems with learning/using the tools is to allocate more time to mastering their use.

DEVEVLOPMENT PROCESS

CODE REVIEW PROCESS

If this team had multiple human members the team leader would review all code changes. All trivial changes, changes that are required to bring code into line with the design plan, or substantial changes that have been previously discussed at a team meeting will be approved by the team lead. Any changes that are contrary to the design plan and/or will have undesirable consequences will be rejected and added to the list of items to be discussed at the next team meeting.
Since Nicole was the only developer and the team leader she will review all code changes and summarily rejected every merge request forwarded by other team members on the grounds that they are either made of rubber or unqualified to contribute code.

COMMUNICATION TOOLS

Communications software was not necessary since Nicole can read her own mind almost as well as Darmok Nutcracker can read it.

During the final testing phase, Duckbill and any other recruited testers will forward bug reports via email that will be transferred to the GitLab issue tracker by Nicole. Unless, a department member can be ~~conned~~ convinced to participate in this phase of development in which case they will use the GitLab issue tracker directly.

CHANGE MANAGEMENT

Nicole will assess and resolve all bug reports.
If this group had more team members then the Quality Assurance Lead would be someone else's title and that individual would triage all bug reports.

- If the bug report identifies an error in a method then the QA lead will determine which team member wrote the code and assign them to fix their code.
- If the bug report identifies an error in resulting from the interaction of code written by two or more group members and if it is clear the error is due to one member not following the design specifications the QA lead will assign resolution of the bug to that individual.
- If the bug report identifies an error in resulting from the interaction of code written by two or more group members and it is not clear why the bug has appeared it will be discussed at the next group meeting and after discussing it with the other team members the QA lead will assign resolution of the bug to that person.
- Otherwise, the QA lead will reply to the bug report appropriately.

After a bug is resolved (fixed or confirmed but it is decided by the team it will not be fixed) the individual that resolved it will respond to the bug. The response will have two parts: An appropriate tag: Not a Bug,

Works for Me, Confirmed, Fixed, etc.; and a brief description/explanation.
e.g.: If it is not a bug, indicate the design specification related to the issue. If it won't be fixed, indicate why. If it has been fixed, indicate which files were updated.

SOFTWARE DESIGN

DESIGN

Each game has been envisioned as having three components:

1. A collection of pools of dice.
2. A scoring system.
3. A turn management system.

All elements of the games which are not common will appear in subclasses named for the separate games.

DESIGN RATIONALE

The goal of this project, which informed all design decisions, is to develop examples that illustrate the principles taught in CPSC2720 as well as utilize several design patterns taught in the course.
To this end we are using the DRY principal, Agile development techniques, and test driven programming. We are starting by implementing the three components mentioned above independently of each other. Once those are built and tested we will use them to create the games.

We have attempted to use the Factory Method design pattern, the composite design pattern, the state design pattern, and the template design pattern. Dame Nutḳuacker was particularly keen to see a PoolsOfDice Factory implemented. Dr. Anvik, an expert in the area of software engineering and the project pedagogical advisor, suggested using the composite pattern for the score card design.

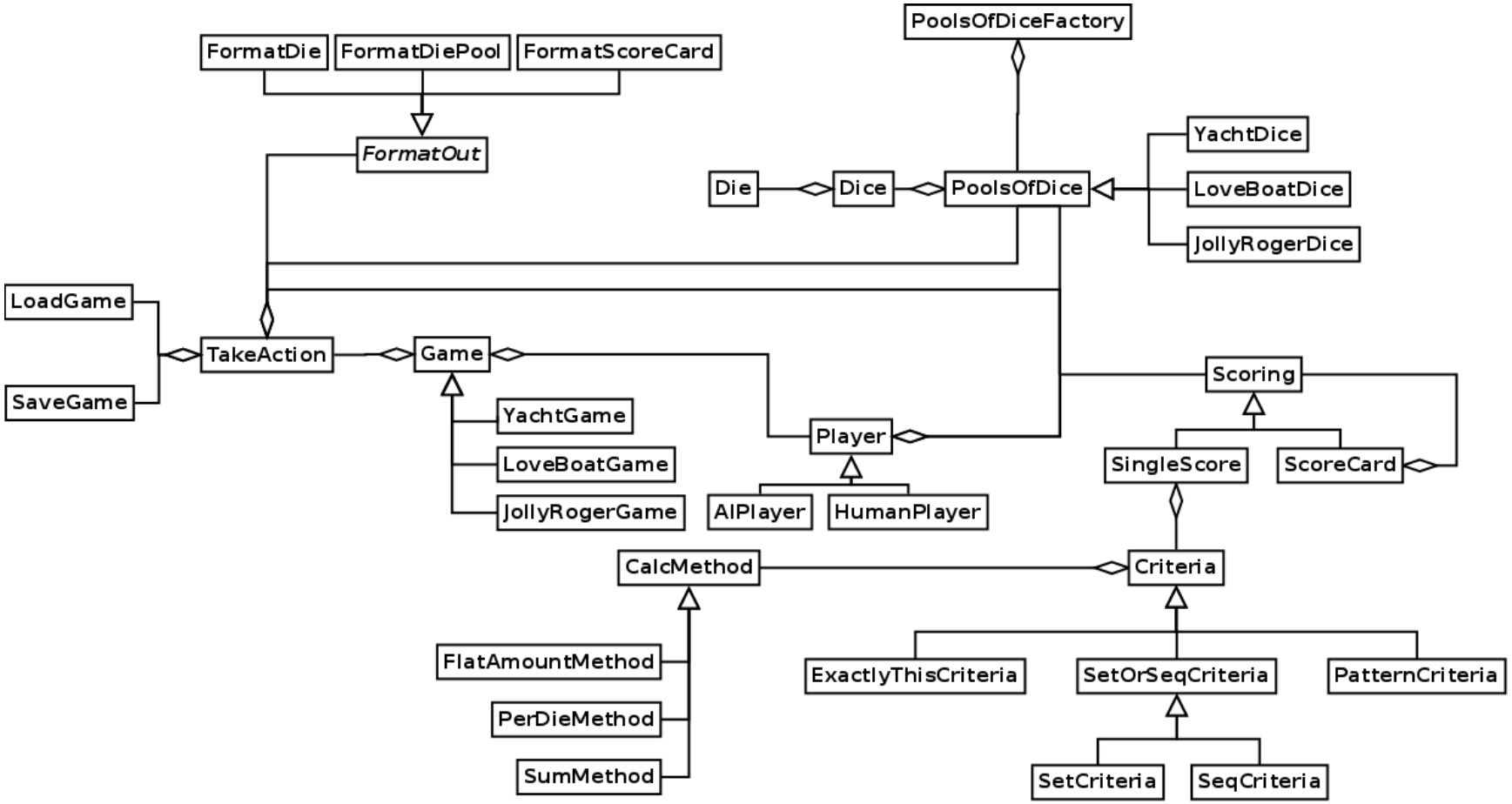
The specific outcomes of the design decision can be found in the UML diagrams and sequence diagrams found in Appendix A.

APPENDICES

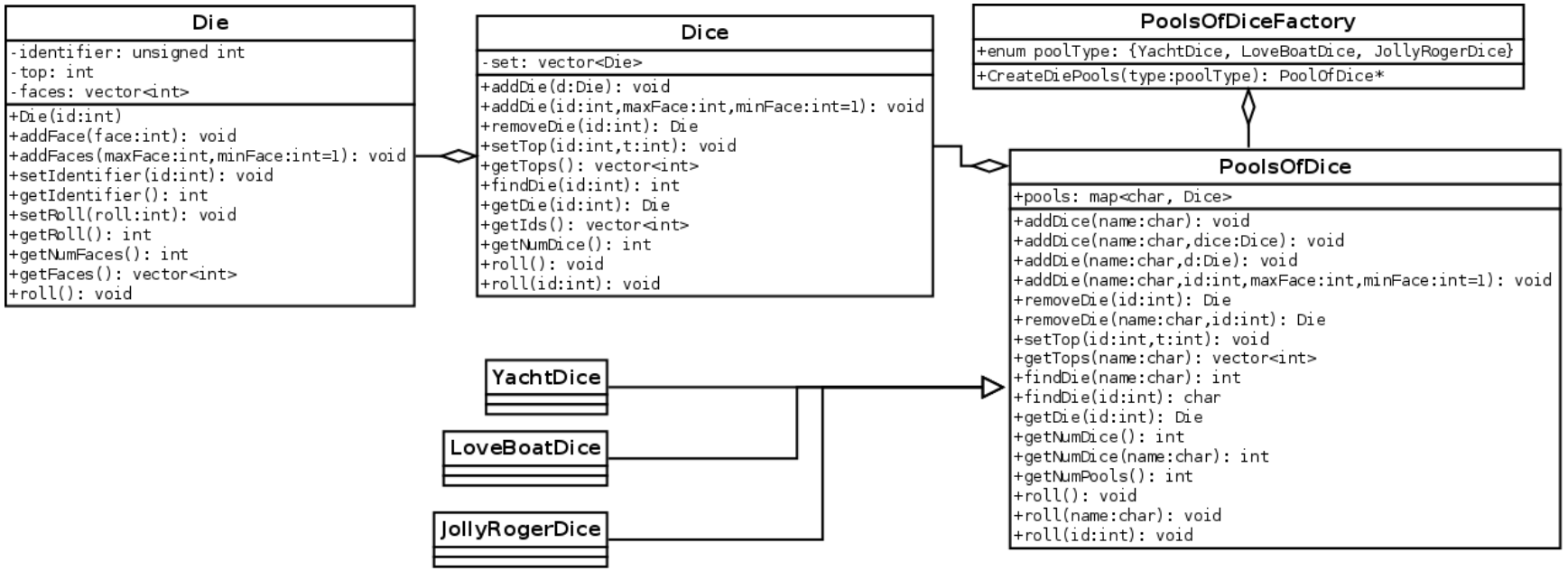
APPENDIX A: FIGURES AND TABLES

CLASS DIAGRAMS

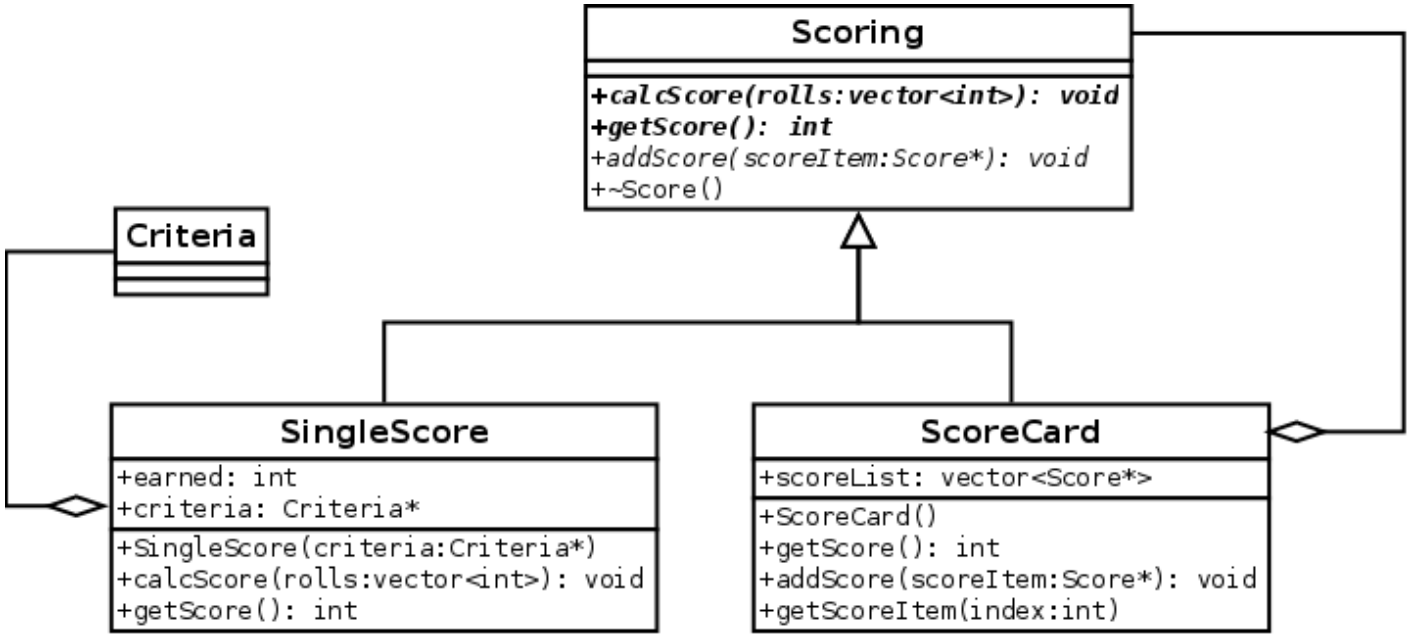
1. Overview (includes all the classes other than the Exceptions classes which are housed together in Exceptions.h and used by almost every other class)



2. Pools of Dice Classes (Factory Method)

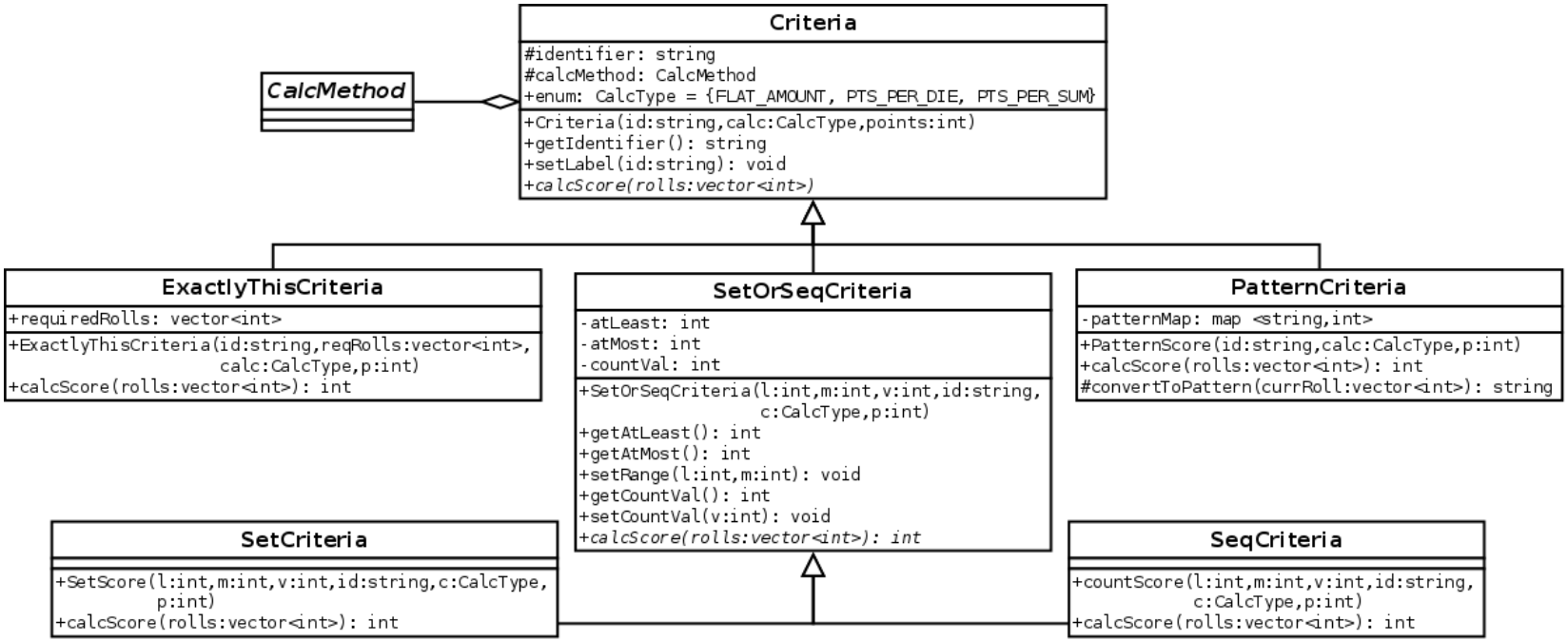


3. Scoring Classes (Composite Method)

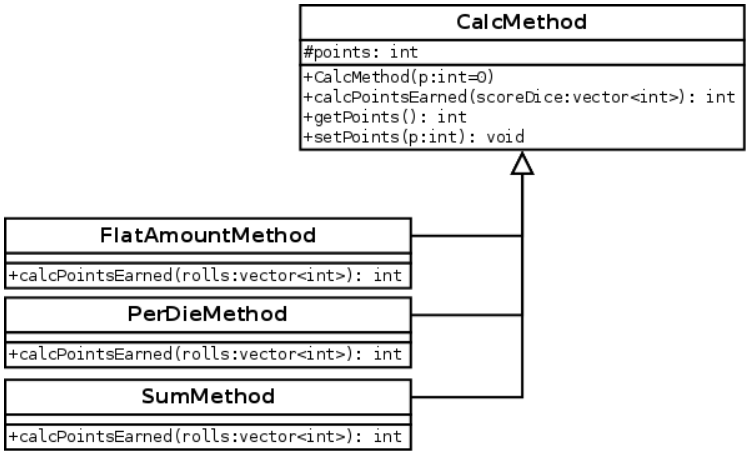


Criteria can be found on the next page.

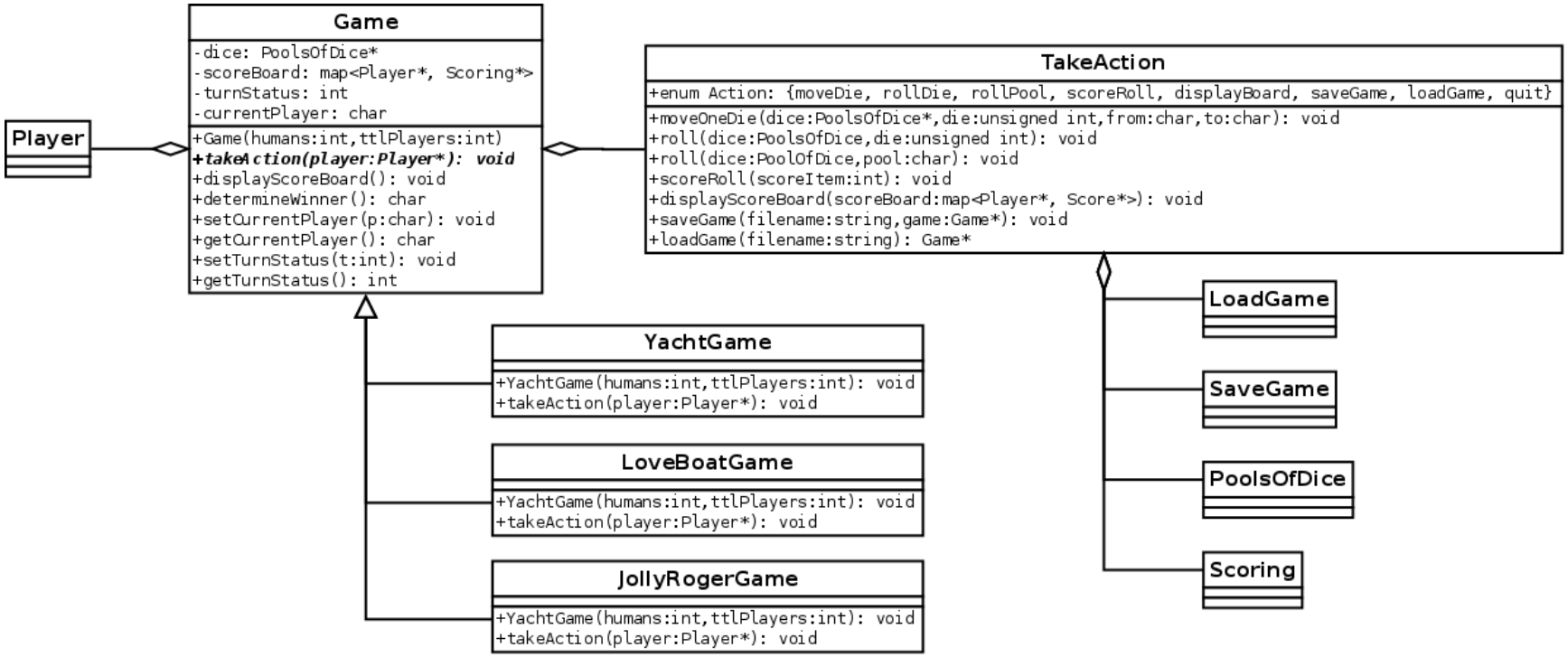
Criteria (Template)



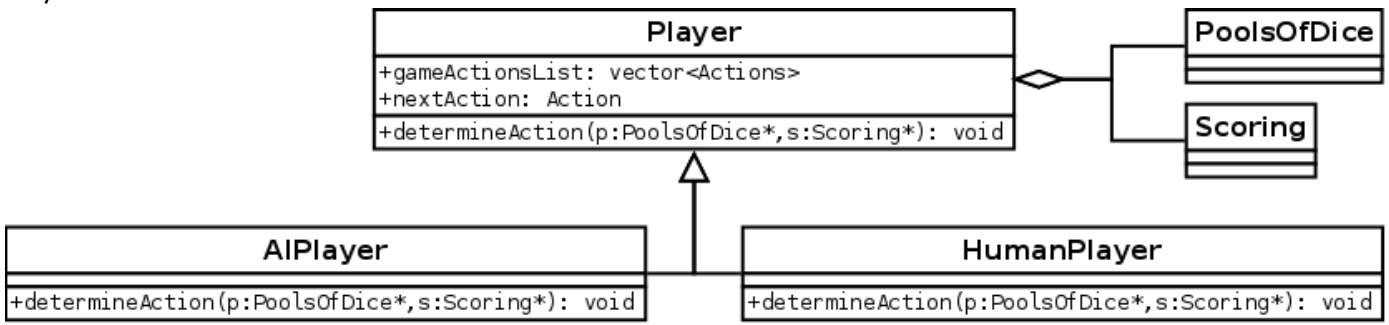
CalcMethod



4. Play Turns

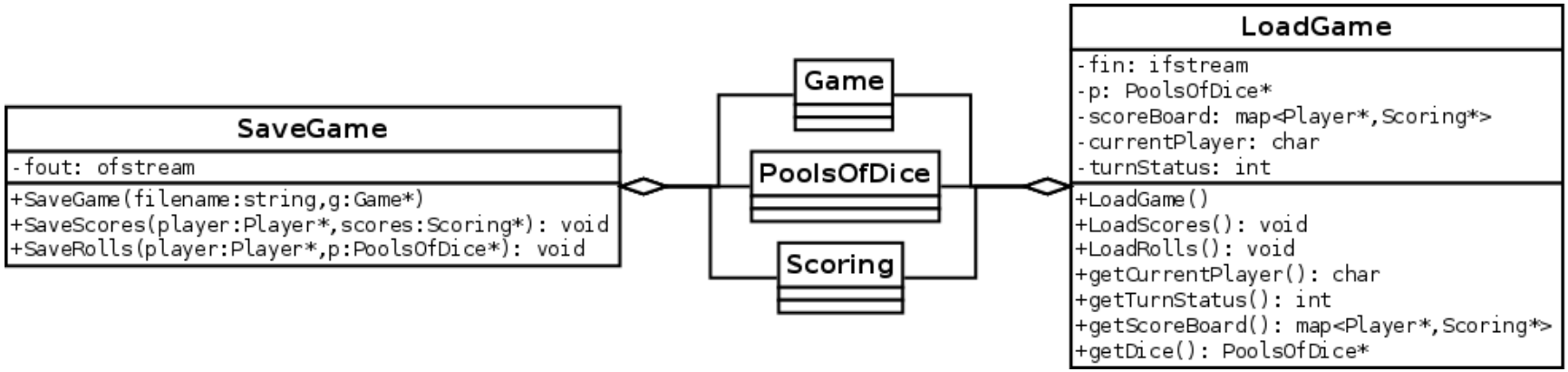


Player

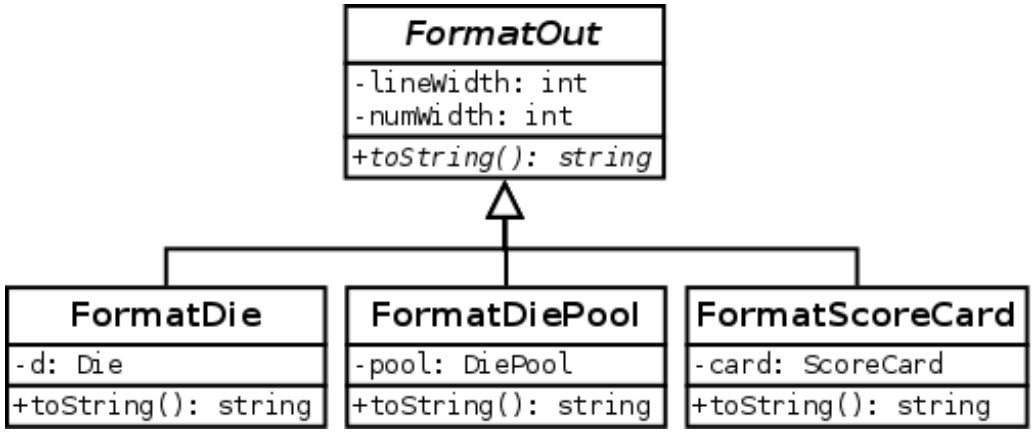


5. File Handling & Formatting for Screen output

Load and Save

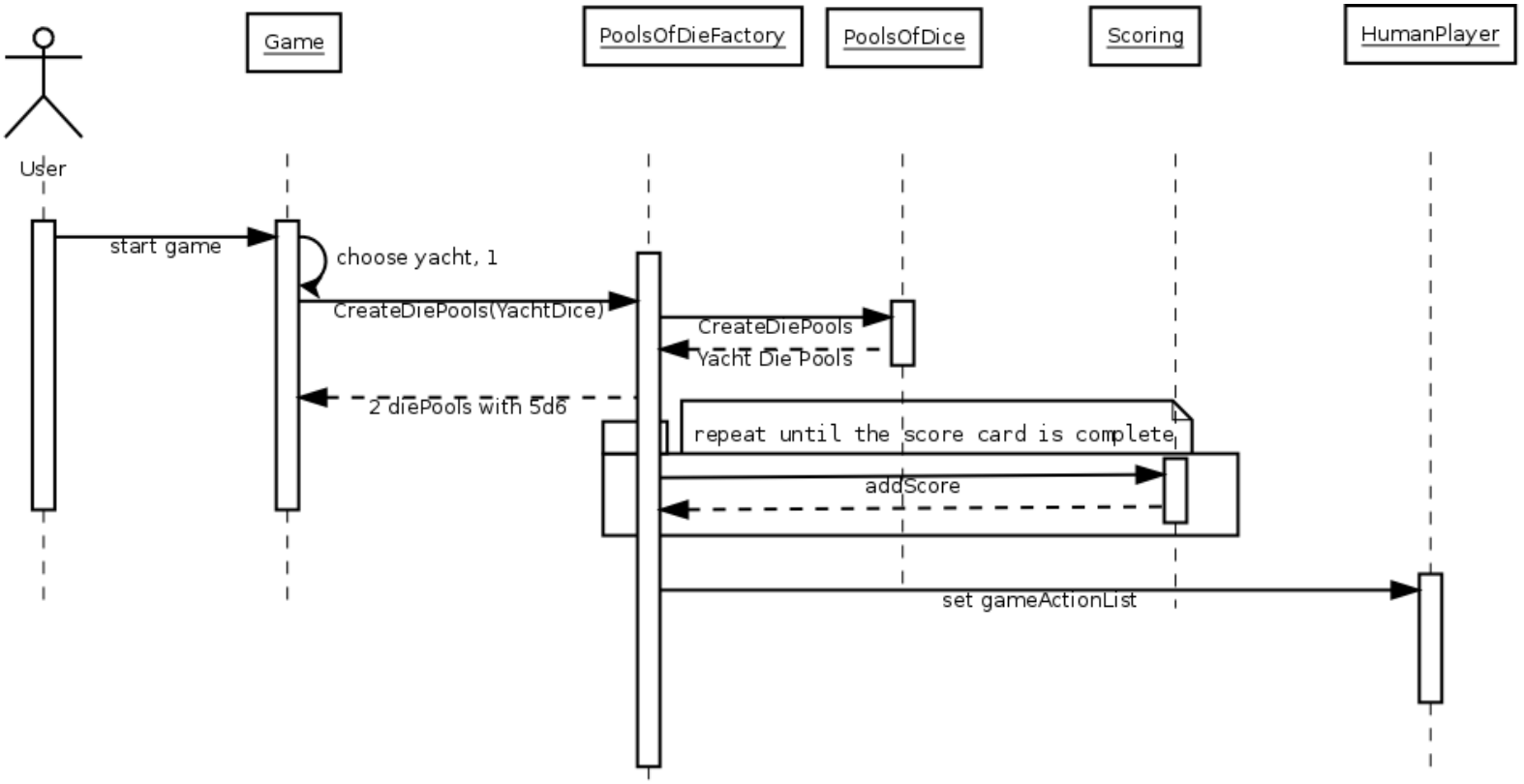


Formatting



Sequence Diagrams

1. Starting a 1 player game of Yacht.



2. A human player takes a turn of the game Jolly Roger.