Top-Down Design, Nested Loops

Rose-Hulman Institute of Technology

Computer Science and Software Engineering

Check out 14-NestedLoops from SVN

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Exam Debriefing

- Problem discussion
- Student questions
- How did the class do?
- What should you do?
- If a problem was mis-graded …

Team Preference Survey

- Team project preview starts session 15
- Complete ANGEL survey to help me set up teams
  - Preferred partners
  - “Vetoes”
- Suggestion: prefer people whose understanding level is similar to yours
- Do it during today’s break
- Due at 4:00 today

Today's Plan

1. Begin designing a program to play blackjack
   – Tomorrow we will do detailed design and some implementation.
2. Practice with *nested loops*

Designing/Implementing a Larger Program

- Most of our programs have been small
- For larger programs, we need a strategy
- One common strategy: *top-down design*
  - Break the problem into a few big pieces
    - One function for each piece
  - Break each piece into smaller pieces
  - Continue until the pieces are “bite size”

Q1-2

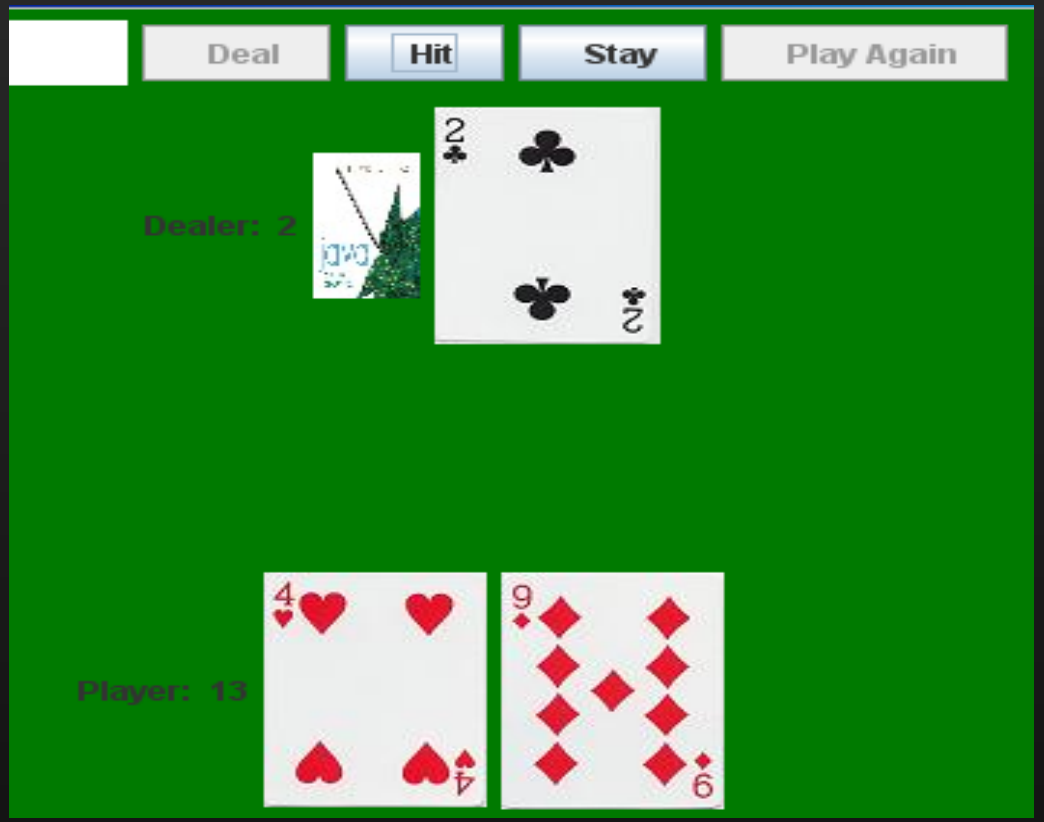
Example: Two-player Blackjack (21)

- Uses a regular deck of cards
- Player and Dealer each initially get two cards
- Player can see both of own cards, but only one of dealer's
- Suit doesn't matter
- Denomination determines points per card:
  - Ace: one point or 11 points
  - 2-10: point value is the number of the card.
  - Face card: 10 points
- Object: Get as close as you can to 21 points in your hand without going over

Q3a

Blackjack Illustration

From Lewis and Chase,
Java Software Structures



Blackjack play

- Player options
  - Take one or more *hits* (cards)
  - Or *stay* (keep the current hand)
- If a hit increases the Player's score to more than 21, then Player is *busted* and loses
- If the Player is not busted, the Dealer plays, but with more constraints
  - If the Dealer's score is less than 16, Dealer must take a hit
  - Otherwise, Dealer must stay
- If neither player is busted, the one with the highest-scoring hand wins

Q3b

Program Specification

- The blackjack program will allow a single player to play one hand of blackjack against the computer
- The computer will be the dealer
- The game will start with a fresh deck of cards
- The program will have a simple text interface
- It will repeatedly display the state of the game and ask the Player whether he or she wants a hit
- Once the Player says NO, the Dealer will play
- The game results will be displayed

Initial Design

- Similar to the top-level design of the Racquetball simulator from the textbook
- Want to break up the blackjack algorithm into a few high-level tasks

Top-Down Design

- After defining the high level tasks, we “stub in” the *top-level functions* of the program

Nested Loops

- A nested **if** is an **if** inside an **if**.
- A nested loop is a loop inside a loop.
- Example:

```
for i in range(4):
    for j in range(3):
        print(i, j, i*j)
```

- What does it print?
- What if we change the second range expression to `range(i+1)` ?

Q6-9

Nested Loops – Class Exercise

- Write a function **rectangleOfStars(rows, columns)**
- It should print a pattern of asterisks like

```
***********
***********
***********
```

Output for invocation **rectangleOfStars(3,11)**

Homework 14 includes ten more
nested loop problems like **rectangleOfStars**

Nested Loop Practice

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