

Code Design Using Functions

CSE 1310 – Introduction to Computers and Programming
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Revisit the `check_integer` Function

- Rules we must enforce:
 - Can have spaces at the beginning.
 - First non-space character should be number or minus sign.
 - Rest of non-space characters should be digits from 0 to 9.
 - Can have spaces at the end.
 - No spaces allowed except at beginning and end.

Revisit the **check_integer** Function

- Design approach: make a function using each rule.
- The idea is that each function should do something about a specific rule, so that we do not need to worry about that rule later.

The Master Mind Game

- Player 1: picks a four-digit number, using only digits 1 to 6 (can use the same digit multiple times).
 - Examples:
 - 4412
 - 5631
 - 2242
 - 1551
- Player 2: tries to guess the number.
- (note: the original game uses colored pegs of six different colors, not digits from 1 to 6).

The Master Mind Game

- Step 1: player 1 picks the number.
- Step 2: player 2 enters a guess.
- Step 3: player 1 produces an answer:
 - An "o" for every digit in the guess that appears at **the exact same location** in the actual number.
 - An "x" for every digit in the guess that appears in the actual number, but **not in the same location as in the guess**.
 - For each digit in the guess, we get either a single "o", or a single "x", or nothing. **A single digit in the guess cannot generate more than one letter in the answer.**
- If guess was incorrect, go back to step 2, else game over.

Example Game

- Player 1 picks: 4525
- Guess 1: 1234 Answer 1: xx
- Guess 2: 1465 Answer 1: ox
- Guess 3: 6426 Answer 1: ox
- Guess 1: 5425 Answer 1: ooxx
- Guess 1: 4525 Answer 1: oooo

Task: Implement Master Mind

- The computer should be able to play both roles:
- First role:
 - the computer picks number
 - the human guesses
 - the computer computes answers
- Second role:
 - the human picks number
 - the computer guesses
 - the human computes answers

Functions

- A function that the computer uses to pick a valid number, that:
 - has four digits.
 - each digit is a number between 1 and 6.
- Specs:
 - Name: `pick_number`
 - Arguments: none
 - Output: string of the four-digit number

Functions

- A function that compares the true answer with the user's guess.
- Specs:
 - Name: `compute_answer`
 - Two arguments: right answer (the 4-digit number that was originally picked) and guess (the 4-digit guess from the user)
 - Output: o's and x's

Functions

- Playing a game, where computer picks and human guesses.
- Specs:
 - Name: `play_computer_picks`
 - Arguments: none
 - Output: number of guesses it took till right answer. Return `None` if user gives up.

Functions

- A function that determines if a digit in the guess is in the right spot.
- Specs:
 - Name: `check_right_spot`
 - arguments: right answer, guess, digit_position
 - Output: boolean, true if in right spot, false otherwise.

Functions

- A function that determines if a digit in the guess is in the wrong spot.
- Specs:
 - Name: `check_wrong_spot`
 - arguments: right answer, guess, digit_position
 - Output: boolean, true if in right spot, false otherwise.

Top Level Function

- (still incomplete, this is how far we got by the end of the lecture on Wednesday 7/25):

```
def play_computer_picks():  
    number_of_guesses = 0  
  
    pick = pick_number()  
    guess = get_guess_from_user()  
    number_of_guesses = number_of_guesses + 1  
    answer = compute_answer(pick, guess)  
    print "the answer is", answer
```

Remaining Tasks for Master Mind

- Finish implementation of Master Mind, for the case where the computer picks a number and the human guesses.
- Design and implement code for the case where the human picks a number and the computer guesses.
 - Think of possible strategies.

Other Game-Related Code Projects

- The Connect 4 game.
 - http://en.wikipedia.org/wiki/Connect_Four
- The Othello/Reversi game.
 - <http://en.wikipedia.org/wiki/Reversi>
- Tic-tac-toe.
 - <http://en.wikipedia.org/wiki/Tic-tac-toe>
- The battleship game.
 - http://en.wikipedia.org/wiki/Battleship_%28game%29
- The L-game.
 - http://en.wikipedia.org/wiki/L_game
- The hearts card game.
 - <http://en.wikipedia.org/wiki/Hearts>

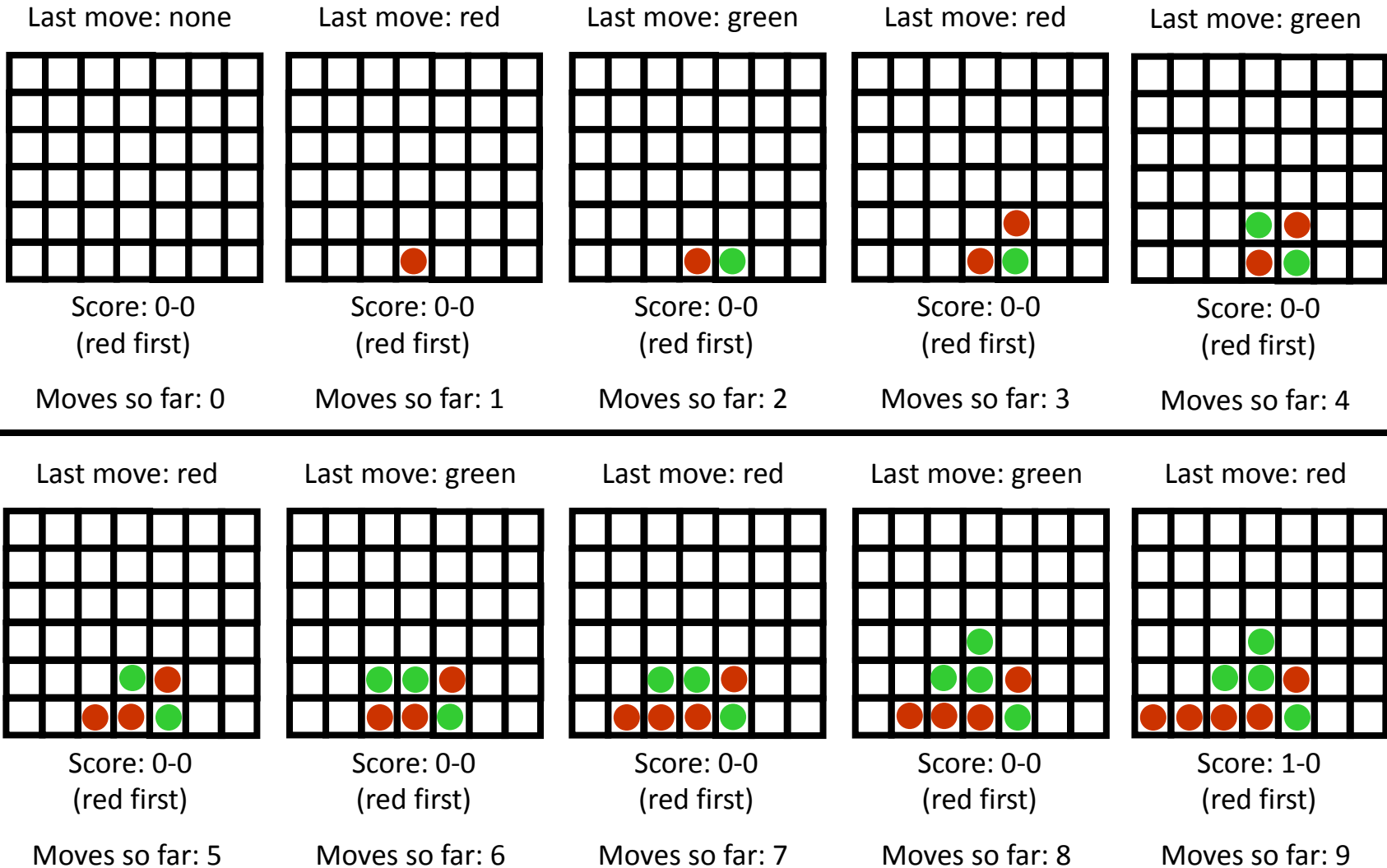
Other Code Projects

- Re-designing the `check_integer` function.
 - How can we simplify the design, so that we come up with an intuitive and straightforward implementation?
- Solving puzzles:
 - The liar's puzzle.
 - The missionaries-and-cannibals problem.
 - The family river-crossing problem.
 - Sudoku puzzles.
- An Eliza system (a computer psychoanalyst).

The Connect-4 Game

- Played on a grid, 7 columns wide, 6 rows high.
- Two players, one red, one green, taking turns.
- When it is your turn:
 - You place a piece of your color into one of the 7 columns.
 - The piece falls down to the lowest free spot in that column.
- If you form a sequence of four consecutive pieces of your color, you win.
 - The consecutive pieces may be oriented horizontally (on the same row), vertically (on the same column) or diagonally (from bottom-left to top-right or from bottom-right to top-left).
- More info: http://en.wikipedia.org/wiki/Connect_Four

The Connect-4 Game



The Liars Puzzle

- From "Structure and Interpretation of Computer Programs", by Abelson, Sussman, and Sussman, 2nd edition.
- Five schoolgirls sat for an examination. Their parents –so they thought- showed an undue degree of interest in the result. They therefore agreed that, in writing home about the examination, each girl should make one true statement and one untrue one. The following are the relevant passages from their letters:
 - Betty: "Kitty was second in the exam. I was third."
 - Ethel: "I was first in the exam. Joan was second."
 - Joan: "I was third, and Ethel was bottom."
 - Kitty: "I was second, and Mary was fourth."
 - Mary: "I was fourth, and Betty was first."
- What was the true order in which the five girls were placed?

Missionaries and Cannibals

From

http://en.wikipedia.org/wiki/Missionaries_and_cannibals_problem

- Three missionaries and three cannibals must cross a river using a boat with the following constraints:
 - The boat can carry at most two people.
 - For both banks, if there are missionaries present on the bank, they cannot be outnumbered by cannibals (if they were, the cannibals would eat the missionaries.)
 - The boat cannot cross the river by itself with no people on board.

Family River-Crossing Problem

From

http://en.wikipedia.org/wiki/Propositiones_ad_Acuendos_Juvenes

- A man and a woman of equal weight, together with two children, each of half their weight, wish to cross a river using a boat, under these constraints:
 - The boat can only carry the weight of one adult.
 - The boat cannot cross the river by itself with no people on board.