Nick Troccoli
CS 106A

Solutions to Midterm Exam

Problem 1: Karel the Robot

```
public class FarmerKarel extends SuperKarel {
      public void run() {
            checkRow();
            while (leftIsClear()) {
                  moveToNextRow();
                  checkRow();
            }
      }

      /* Precondition: Karel is facing East with at least 1 row above it.
       * Postcondition: Karel is facing East one row up.
       */
      private void moveToNextRow() {
            turnLeft();
            move();
            turnRight();
      }

      /* Precondition: Karel is facing East at the beginning of a row.
       * Postcondition: Karel is in the same position, but has put all
       * of the beepers in the row on that square.
       */
      private void checkRow() {
            if (frontIsClear()) {
                  goToBeeper();
                  while (beepersPresent()) {
                        bringBeeperHome();
                        goToBeeper();
                  }
                  turnAround();
                  moveToWall();
                  turnAround();
            }
      }

      /* Precondition: Karel is not facing a wall.
       * Postcondition: Karel has moved until it reaches a beeper or a wall.
       */
      private void goToBeeper() {
            move();
            while (frontIsClear() && noBeepersPresent()) {
                  move();
            }
      }

      /* Precondition: Karel is standing on a beeper, facing East
       * Postcondition: Karel is standing on the leftmost square of
       * the same row, facing East, with the beeper now on that square.
       */
      private void bringBeeperHome() {
            pickBeeper();
            turnAround();
            moveToWall();
```

```
            turnAround();
            putBeeper();
      }

      /* Precondition: NA
       * Postcondition: Karel has moved straight until it reaches a wall.
       */
      private void moveToWall() {
            while (frontIsClear()) {
                  move();
            }
      }
}
```

Problem 2: Java Statements and Expressions

(2a)

`1 + (2 + "B") + 'A'`	`"12BA"`
`11 / 2 > 5 || 5 % 2 == 1`	`true`
`(char)('B' + 2) + "" + 4 + 27 / 3`	`"D49"`
`21 / 2.0 + 3 % 4 - 23 / 2`	`2.5`
`!(3 / 2 < 1.5) && (4 > 5 || 2 % 3 == 0)`	`false`

(2b) What are the color, dimensions and location of **`rect`** on the canvas?

```
x = 9
y = 9
width = 12
height = 35
color is red
```

Problem 3: Console Programs

Note that exact output matching was not required as long as the functionality was correct.

```
public class MovieKiosk extends ConsoleProgram {
      public void run() {
            String movieNames = "";
            double total = 0;
            int voucher = 0;

            String movieName = readLine("Movie name: ");
            while (movieName.length() > 0) {
                  int numTickets = readInt("# tickets: ");
                  double ticketPrice = readDouble("Ticket price: ");

                  /* If the voucher doesn't cover the total cost, add
                   * the remaining balance to total.  Otherwise,
                   * the user owes nothing (the voucher covers it all)
                   */
                  if (voucher < ticketPrice * numTickets) {
                        total += numTickets * ticketPrice - voucher;
                  }
                  voucher = 0;

                  // Randomly award a voucher for the next purchase
                  if (RandomGenerator.getInstance().nextBoolean(0.1)) {
                        voucher = RandomGenerator.getInstance()
                                    .nextInt(5, 25);
                        println("You've won a $" + voucher +
                                    " voucher for your next purchase!");
                  }

                  // Add the movie name to our string
                  if (movieNames.equals("")) {
                        movieNames = movieName;
                  } else {
                        movieNames += " and " + movieName;
                  }
                  println();

                  movieName = readLine("Movie name: ");
            }

            println();
            if (!movieNames.equals("")) {
                  println("Movies: " + movieNames);
                  println("Total: $" + total);
            } else {
                  println("Movies: None");
            }
      }
}
```

Problem 4: Graphics Programs

```
public class StickHero extends GraphicsProgram {
	private boolean isOriginalSize;
	private GImage player;

	public void run() {
		isOriginalSize = true;
		player = new GImage("res/player.png");
		add(player, 0, getHeight() / 2.0 - player.getHeight() / 2.0);

		// Animate the player across the screen
		while (true) {
			player.move(5, 0);

			// If the player reaches the right edge, move to the left edge
			if (player.getX() + player.getWidth() >= getWidth()) {
				player.setLocation(0, getHeight() / 2.0 -
							player.getHeight() / 2.0);
			}
			pause(30);
		}
	}

	public void mouseClicked(MouseEvent e) {
		GObject obj = getElementAt(e.getX(), e.getY());
		if (obj == player) {
			if (isOriginalSize) {
				// double the size while keeping the center the same
				player.setX(player.getX() - player.getWidth() / 2.0);
				player.setY(player.getY() - player.getHeight() / 2.0);
				player.setSize(2*player.getWidth(), 2*player.getHeight());
			} else {
				// half the size while keeping the center the same
				player.setX(player.getX() + player.getWidth() / 4.0);
				player.setY(player.getY() + player.getHeight() / 4.0);
				player.setSize(0.5*player.getWidth(),
							0.5*player.getHeight());
			}
			isOriginalSize = !isOriginalSize;   // flip the boolean
		}
	}
}
```

Problem 5: Text Processing

(5a)

```
private String replaceMention(String str) {
	if (str.length() == 0 || str.charAt(0) != '@') return str;

	// If only one name, just remove the '@'
	if (countUppercaseLetters(str) == 1) {
		return str.substring(1);
	}

	// Build up a new string with the mention expanded
	String newStr = "";
	for (int i = 1; i < str.length(); i++) {
		char ch = str.charAt(i);

		// If it's upper case, check if it's the last uppercase letter
		if (Character.isUpperCase(ch)) {

			// If it's the last name, print out initial + '.' and return
			if (countUppercaseLetters(str.substring(i+1)) == 0) {
				newStr += " " + ch + ".";
				return newStr;
			} else {
				/* Otherwise, it's the start of a new middle name,
				 * so add a space before.
				 */
				newStr += " " + ch;
			}
		} else {
			// Otherwise, append the character as normal
			newStr += ch;
		}
	}

	return newStr;
}

// A helper method that returns the number of uppercase letters in the given string.
private int countUppercaseLetters(String str) {
	int count = 0;
	for (int i = 0; i < str.length(); i++) {
		if (Character.isUpperCase(str.charAt(i))) {
			count++;
		}
	}

	return count;
}
```

(5b)

```
public class ReplaceMentions extends ConsoleProgram {
      public void run() {
            String filename = promptUserForFile("Enter filename: ", "res");
            try {
                  Scanner s = new Scanner(new File(filename));

                  // We can assume only 1 line, so we need only 1 scanner
                  while (s.hasNext()) {
                        print(replaceMention(s.next()) + " ");
                  }
                  s.close();
            } catch (IOException e) {
                  println("File could not be read.");
            }
      }
}
```