Queen Mary
University of London

Main Examination Period 2019

ECS405U Arts Application Programming *Duration: 2 hours 30 minutes*

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Answer ALL FOUR questions

Cross out any answers that you do not wish to be marked

Calculators are not permitted in this examination. Please state on your answer book the name and type of machine used.

Complete all rough workings in the answer book and cross through any work that is not to be assessed.

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EXAM PAPERS MUST NOT BE REMOVED FROM THE EXAM ROOM

Examiners:Dr Karen Shoop, Dr Matthew Purver

Question 1

a) A Processing sketch starts by initialising a variable called speed with value 40.5. Write this line of code and explain why a rect function declared inside the draw function will be able to use this variable.

[2 marks]

b) A variable called num is initialised with a randomly generated whole number between 0 and 100 inclusive. If num is both greater than or equal to 40 and less than 70, the letter 'p' plus num is displayed, if less than 40 the letter 'f' plus num is displayed, otherwise the letter 'd' plus num is displayed. Write this code.

[7 marks]

c) Create an array, called mAr, that contains the following five characters – p 7 w £ @ – and then write the code that iterates through mAr, displaying each value in the area below the Processing sketch.

[6 marks]

d) A Processing sketch contains a variable called userArray, an array of user names. A function called howMany takes in one string as a parameter, checks how many times this string appears in userArray, and returns this number.

A variable called user has been initialised with a name. The code passes user into a howMany function call. The value returned from this call is assigned to a variable called total (which has not been declared previously).

i) What is the difference between a function call and a function definition?

ii) Write the howMany function definition. You can assume that the userArray variable has already been initialised and can be accessed by this function.

iii) Write the line of code that calls the howMany function and uses this to initialise the variable named total.

[10 marks]

Question 2

```
class Ball implements Bounce {
  int x;
  int y;
  int d;
  int yspeed;

  Ball() {
    this(90,10);
  }

  Ball(int x1, int y1) {
    x=x1;
    y=y1;
    d=40;
    yspeed=1;
  }

  void highLow() {
    if (*********MISSING CODE*********) {
      yspeed=yspeed*-1;
    }
  }

  void display() {
    highLow();
    ellipse(x, y, d, d);
    ******MISSING CODE************
  }
}//end of class
```

Figure 1

a) A Processing sketch creates balls that respond when they overlap. A first iteration of the Ball class is shown in Figure 1.

i) Explain the meaning of 'implements Bounce' in the class signature.

ii) What is the collective name for the type of variable at the top of the class?

iii) Explain in detail why there are two blocks of code that start with the word Ball.

iv) A ball changes vertical direction when its edge hits the top or bottom of the window. Write the missing code in the highLow function that tests a ball's location.

v) Write the missing line of code inside the display function that changes the y variable by the value of yspeed.

[11 marks]

b) The main sketch window creates objects of type Ball that bounce up and down.

i) Write code that creates a Ball object called b1.

ii) Write the line of code to call the display function, i.e. to display the ball.

iii) Write the line of code to display the ball's y coordinate (i.e. variable called y) in the area below the sketch.

[4 marks]

c) Figure 2 shows the first iteration of a Java class.

```
**MISSING CODE**** java.util.*;


public class Cat extends Animal{
     private int age;
     private double height;
     private int xLoc;

     public Cat(String name){
          super(name);
     }
     public void eat(){
          if(chase()){
               catch();
          }
     }
}
```

Figure 2

i) What term is missing at the top of the file, before java.util.*;

ii) Why is the purpose of the asterisk (*) after java.util.?

iii) Explain in detail the purpose of 'extends Animal' plus the purpose of other code related to this inside the Cat class.

iv) Explain, with reference to the term encapsulation, why 'private' is written before each variable at the top of the class.

v) Add a method that lets other code get the value of a Cat object's xLoc.

[10 marks]

Question 3

a) A ball is semi-transparent, with colour set randomly on a continuum from orange to yellow.

i) Write the line of code that sets a ball's colour. Assume the colorMode is RGB.

ii) Write, using hexadecimal, the line of code that sets an outline to be semi-transparent red, and using the different hexadecimal format, the code that sets the inside of a shape to be semi-transparent green (do not write the shape).

[9 marks]

b) Write the line of code to avoid showing a trail for each ball against the white window, and state where this line should be located in the draw function.

[3 marks]

c) A blue Pac-Man, diameter 60 pixels with turquoise eye, diameter 5 pixels, starts halfway down the window and moves to the right. When the whole Pac-Man disappears from the right-hand side of the window it reappears on the left. This should work for any window size.

i) Explain why PI is written as an upper-case word in Processing, even though it is a number.

ii) Write the code to draw the Pac-Man, including colour, eye and movement. You should use a variable called x for the x-coordinate (assume that x has been defined and is accessible by your code).

iii) Write the check() function: this checks if the Pac-Man has just disappeared from the window. If so, it resets x so that the Pac-Man just reappears on the left (assume that check() can access x).

[10 Marks]

d) A ball's colour changes when the Pac-Man intersects. Write the intersect function for the Ball class in Figure 1 that returns true if there is an overlap between the Pac-Man and the ball. This will need to be passed three parameters, representing the x and y coordinates and diameter of the Pac-Man. The Processing dist function – dist(x1, y1, x2, y2) – may be helpful to show the distance between two points.

[3 Marks]

Question 4

a) A visualisation shows the ranking of the most popular passwords and their categories: '12345678' is ranked second, with strength 4 and category 'alphanumeric'; 'superman' is ranked 22nd with strength 10, category 'name'; 'ranger' is ranked 27th with strength 7, category 'cool'; 'pass' is ranked 35th with strength 3, category 'password'. Write this data formatted as a CSV file, converting the rankings to a number (e.g. 22nd ->22).

[3 marks]

b) The data is stored in the file *password.csv* and read into a table in a Processing sketch.

i) Write the code that reads the file into a Table object called data. Assume that this variable has already been declared.

ii) Why is this line of code written inside the setup function, or a function called by setup, instead of inside the draw function?

[5 marks]

c) Figure 3 shows the first iteration of the visualisation. Write the code that draws the y-axis as a vertical line 40 pixels from the left edge, starting 10 pixels down from the top of the window and ending 10 pixels above the bottom of the window, where it meets the x-axis. Your code should also display the word 'rank' just to the right of the line.

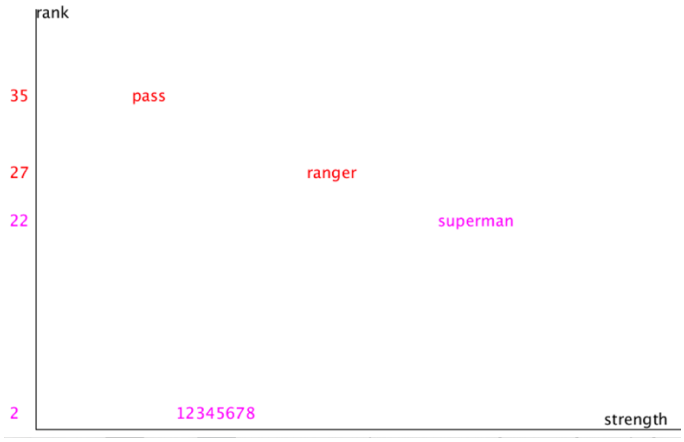

Figure 3

[4 marks]

d) Write the code that iterates through data (the table) to display the password information, as shown in Figure 3, so that:

i) The colour is set according to password length: red for password length less than 8, otherwise magenta for password length less than 11, otherwise green;

ii) The ranking value is shown in the y-axis, with lowest rank closest to the bottom;

iii) The password is displayed at the same level of the ranking, with higher-strength passwords further to the right. For simplicity multiply the strength by 50 to set the x-coordinate.

[8 Marks]

e) Write the code to display the category of each password immediately after the password, e.g. ‘ranger, category=cool’, when the user presses the c on the keyboard. For simplicity, assume that each letter is 12 pixels wide, e.g. pass takes up 48 pixels. When the user presses the letter r, the category no longer appears.

[5 marks]

End of Paper