

CMPT166: Midterm

Last name *exactly as it appears on your student card*

First name

Student number								
SFU Email								

This is a **50 minute** test. It is **closed book**: no calculators, computers, notes, books, etc. are allowed.

Question	Mark	Out of
Short answer		25
Conditional Statements		10
Programming Question 1		10
Programming Question 2		15
Bonus		5
Total		60

Short Answer

(25 marks) For each question, write the answer in the box provided (I have elaborated on the True/False questions of educational purposes. For the test, True or False were acceptable answers).

(1 mark) What does RAM stand for?	Random Access Memory
(1 mark) About how many low level operations can a 3 giga herz CPU perform?	About 3 billion
(1 mark) True or False: Processing is based off of the C programming language.	False. Processing is base of C
(1 mark) True or False: global variables in processing are defined inside the "setup()" function.	False. They must be defined outside of any function
(1 mark) Assuming a screen of size 500-by-500, what are the coordinates of the lower left corner of the screen?	(0,499) (0, 500) is acceptable as well
(1 mark) What is the RGB triplet for the color green?	(0, 255, 0)
(1 mark) How can we control the number of times a second Processing calls the "draw()" function?	using the 'frameRate(...)' function
(1 mark) Write a Processing statement that draws an ellipse at the location of the mouse pointer, of width 30 and height 30.	<code>ellipse(mouseX, mouseY, 30, 30);</code>
(1 mark) Use at most two statements to draw a rectangle centred at the location of the mouse, having width 150 and height 100.	<pre>rectMode(CENTER); rect(mouseX, mouseY, 150, 100);</pre> <p>or</p> <pre>rect(mouseX - 150/2, mouseY - 100/2,</pre>
(1 mark) True or False. A variable of type int can store only whole numbers.	True. 'int' stands for integer

<p>(1 mark) What is the result of the following statements:</p> <pre>float x = 4; float y = 4; if (x >= y) { println(x*y); }</pre>	<p>16 is printed to the screen.</p>
<p>(1 mark) True or False. The following code works without error:</p> <pre>if (10 > 5) { String str = "Hi!"; } println(str);</pre>	<p>False. The variable 'str' only exists within the scope of the if-block, since that's where it was declared. When the println statement is called, 'str' is unavailable.</p>
<p>(1 mark) True or False. The following code works without error:</p> <pre>String str = "Hi" + 5;</pre>	<p>True. The statement "Hi" + 5 results in the <i>int</i> 5 being converted to a <i>String</i> "5" and concatenated to "Hi". Then "Hi5" is stored in the variable 'str' of type String</p>
<p>(1 mark) True or False. The following code works without error:</p> <pre>String str = 25;</pre>	<p>False. Processing will not convert 25 to a string before attempting to store it in str</p>
<p>(1 mark) What is the result of the following statements (assume a screen of size 500×500)</p> <pre>translate(250, 250); ellipse(0, 0, 100, 100);</pre>	<p>The origin of the coordinate is moved to (250, 250), and a circle of diameter 100 is drawn in centred around the new origin.</p>
<p>(1 mark) What type of variable does Processing use to store fonts?</p>	<p>PFont</p>
<p>(1 mark) True or False: A String is a primitive data type</p>	<p>False</p>

<p>(2 marks) Assuming a global image variable by the name of <i>bg</i> has been declared for you, write the statements necessary to load an image named "background.png" from disk, and set it as the background. Assume the picture is in the same directory as the source code.</p>	<pre>// in setup() bg = loadImage("background.png"); // in draw() background(bg);</pre>
<p>Suppose you have a program which animates a ball, using variables <i>x</i>, <i>y</i>, <i>dx</i>, and <i>dy</i>. With each call to "draw()", the <i>x</i>, <i>y</i> values of the ball are updated as follows:</p> <pre>// earlier code x += dx; y += dy; // other code follows</pre>	
<p>(1 mark) If $dx = 2$, $dy = 5$, and the ball is at position (2, 2), at what position will the ball be drawn during the next call to "draw()"</p>	<p>(4,7)</p>
<p>(1 mark each) For the following questions, write down the direction the ball travels in given <i>dx</i> and <i>dy</i>. Answer one of "left", "right", "up", "down", "left-up", "left-down", "right-up", "right-down"</p> <ul style="list-style-type: none"> • $dx = -3$ and $dy = 2$ • $dx = 10$ and $dy = 0$ • $dx = 2$ and $dy = 1$ • $dx = 1$ and $dy = -1$ 	<p>left-down</p> <p>right</p> <p>right-down</p> <p>right-up</p>

(1 mark) Write the Processing statement necessary to change the direction of the ball along the x-axis.

```
dx = -dx;
```

Conditional statements

(10 marks + 2 bonus points) Each of the following questions asks that you write an if statement describing the conditions of the question.

<p>(2 marks) Suppose you have two float variables <code>x</code> and <code>y</code>. Write an if-statement that prints “Hello” only when <code>x</code> and <code>y</code> have different values.</p>	<pre>if (x != y) { println("Hello"); }</pre>
<p>(1 bonus) Write the same statement without using the “<code>!=</code>” operator.</p>	<pre>if ((x > y) (x < y)) { println("Hello"); }</pre>
<p>(2 marks) We have two monkeys, Dr. Zaius and Cornelius. We are in good shape if Cornelius is smiling and Dr. Zaius is not. Otherwise, we are in trouble. Assume that we have variables <code>corneliusIsSmiling</code> and <code>drZaiusIsSmiling</code> that keep track of Cornelius’ and Dr. Zaius’ moods. Write an if-else statement that prints “we’re in good shape” when we are in good shape, and “we’re in trouble” otherwise.</p>	<pre>if (corneliusIsSmiling && !drZaiusIsSmiling) { println("we're in good shape"); } else { println("we're in trouble"); }</pre>
<p>(2 marks) Given two floats <code>x</code> and <code>y</code>, write an if statement that prints “Hello” only when at least one of them has value 50.0, or their sum is 50.0</p>	<pre>if (x == 50 y == 50 x + y == 50) { println("Hello"); }</pre>
<p>(2 marks) Given two floats <code>x</code> and <code>y</code>, write an if-statement that prints “Hello” only when one of them is positive and the other is negative.</p>	<pre>if (x < 0 && y > 0) { println("Hello"); } else if (x > 0 && y < 0) { println("Hello"); }</pre>

<p>(1 bonus) This can be done without else-if</p>	<pre>if ((x < 0 && y > 0) (x > 0 && y < 0)) { println("Hello"); }</pre>
<p>(2 marks) Given a float x, write an if-statement that prints "Hello" only when x is a multiple of 7. Otherwise, print "Hi there!", but only when x is even.</p>	<pre>if (x % 7 == 0) { println("Hello"); } else if (x % 2 == 0) { println("Hi there!"); }</pre>

Programming Question 1

(10 marks) Write a full Processing program that creates a screen of size 500 by 500 and draws an ellipse of width 200 and height 200 in the centre of the screen. The ellipse has no stroke. Every thirty frames, the ellipse should change its fill colour, cycling through red, green, and blue.

Recall that the % operator can be used to determine when one number is a multiple of another. Further, the **frameCount** variable keeps track of the total number of calls to the draw() function since the program started.

```
color red = color(255, 0, 0);
color green = color(0, 255, 0);
color blue = color(0, 0, 255);

// the current colour
color curColor;

void setup() {
  size(500, 500);
  curColor = blue;
}

void draw() {
  background(255); // a background was not required by the question
  noStroke();
  // has it been been 30 frames already? better change colours
  if (frameCount % 30 == 0) {
    if (curColor == red) {
      curColor = green;
    } else if (curColor == green) {
      curColor = blue;
    } else { // curColor == blue
      curColor = red;
    }
  }
  fill(curColor);
  ellipse(250, 250, 200, 200);
}
```

Note that with this and the next programming question, we were more interested in the structure and workings of your code, than whether or not you remembered your semi-colons!

Programming Question 2

(15 marks) Write a full Processing program that makes a picture of a ball bounce left and right on the screen, conforming to the following requirements:

- The ball should not leave a trail.
- The ball starts near the middle of the screen and moves horizontally at a **constant speed of 3 pixels per call to draw()**.
- When the ball hits an edge, it reverses direction.
- Clicking **on the ball** while it is in motion stops the ball.
- Clicking **on the ball** while the ball is stopped should make it start moving again.
- The ball should remain entirely on the screen: In other words, you should account for the width and height of the **image** of the ball, and prevent interpenetration.

Hints:

- You may assume that the image of the ball is stored in a file called “ball.png” located in the same folder as the source code.
- Assuming that you have an image stored in a variable “im”, you can access the width and height of the image using

```
im.width; // the width of image im
im.height; // the height of image im
```

- Since an image is a rectangle, you may assume the following function is in your code (you do not need to write it):

```
// Return true if the point (a, b) is in the rectangle
// with top-left corner (x, y), width w and
// height h. Return false otherwise.
boolean pointInRect(a, b, x, y, w, h) {
    return (x <= a && a <= x + w && y <= b && b <= y + h);
}
```

Write your answer in the next page.

Programming Question 2 (Answer)

```
float ballX, ballY, ballDx;

PImage ball;

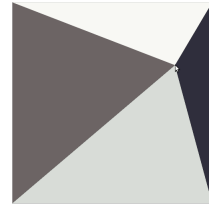
void setup() {
    size(500, 500);
    ball = loadImage("ball.png");
    ballX = 250;
    ballY = 250;
    ballDx = 3;
}

void draw() {
    background(255);
    image(ball, ballX, ballY);
    ballX += ballDx;

    if (ballX <= 0) {
        ballX = 0;
        ballDx = -ballDx;
    }

    if (ballX + ball.width >= 499) {
        ballX = 499 - ball.width;
        ballDx = -ballDx;
    }
}

void mouseClicked() {
    if (pointInRect(mouseX, mouseY, ballX, ballY, ball.width, ball.height)) {
        if (ballDx != 0) { // the ball is moving. Could also use a boolean here.
            ballDx = 0;
        } else {
            ballDx = 3; // dx was 0. We'll set it to 3.
            // note that we weren't asked to keep track of direction
        }
    }
}
```

Bonus Question

(3 marks) Complete the following code so that the program draws 4 differently coloured triangles on the screen. The base of each triangle should be one of the four edges of the screen, and one point of each triangle should follow the mouse pointer:

```

color red = color(255, 0, 0);
color green = color(0, 255, 0);
color blue = color(0, 0, 255);
color yellow = color(255, 255, 0);
void setup() {
    size(500, 500);
}
void draw() {
    background(255);

    // Red triangle
    fill(red);
    triangle(0, 0, 0, 499, mouseX, mouseY);

    // Green triangle
    fill(green);
    triangle(0, 499, 499, 499, mouseX, mouseY);

    // Blue triangle
    fill(blue);
    triangle(499, 499, 499, 0, mouseX, mouseY);

    // Yellow triangle
    fill(yellow);
    triangle(499, 0, 0, 0, mouseX, mouseY);
}

```

Scrap Paper

Scrap Paper