

Assignment 3

DUE DATE: Friday March 8th, 2019 at 4:30 pm.

This assignment covers the topics `chars` and `Strings` and loops.

Notes

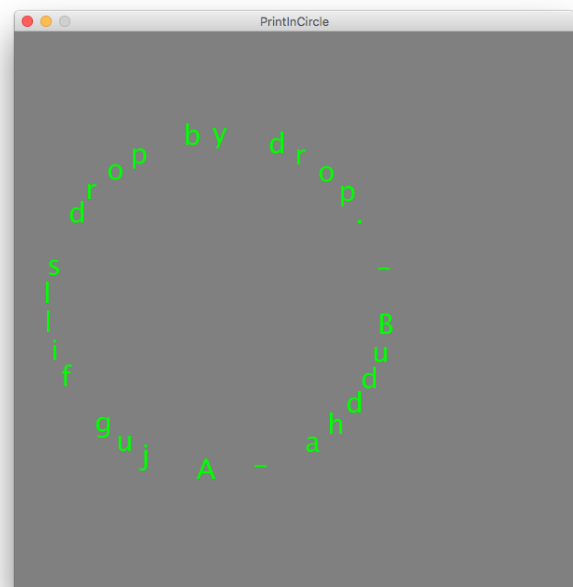
- Name your sketch using your name, the assignment number, and the question number, *exactly* as in this example: `LastnameFirstnameA3Q1`.
- Your program must run upon download to receive any marks.
- Submit one PDE file for each question, or each part, as specified. Do not submit any other types of files.
- Assignments must follow the programming standards document published on the course website on UM Learn.
- After the due date and time, assignments may be submitted but will lose 2% of marks per hour late or portion thereof. The date and time of the last file submitted controls the mark for the entire assignment.
- You may submit the assignment multiple times, but only the most recent version will be marked.
- These assignments are your chance to learn the material for the exams. *Code your assignments independently*. We use software to compare all submitted assignments to each other, and pursue academic dishonestly vigorously.

Question 1: Printing in a Circle

Write an Active Processing program that prints a quotation in a circle; see the example on the right.

Choose a very short quote — a long quote does not fit easily in a circle in a 600×600 canvas. Here are some examples — you can choose from them or find your own:

- Hope is a waking dream. — Aristotle
- I can, therefore I am. — Simone Weil
- Everything you can imagine is real. — Pablo Picasso
- Short cuts make long delays. — J.R.R. Tolkien
- The art is long, life is short. — Hippocrates
- Anger is a short madness. — Horace
- Whatever you are, be a good one. — Abraham Lincoln



The quote is stored as a `String`. In each frame, the quote is printed in a circle around a center point. In each frame, the entire quote is printed one letter at a time at gradually increasing angles around a center point so that the quote is printed in a circle. The starting angle (of the first letter) and the center point of the circle are different for each frame, but each frame shows the entire quote.

Here is what should happen in each frame:

1. Start with a fresh canvas.
2. Choose a random radius for the circle. It can't be too small or the letters will be packed too tightly together to read the quote. The radius also can't be too big or the letters will not all fit on the screen.
3. Choose a random center point for the circle, such that all the letters in the quote will be visible in the canvas using the radius you just generated in the previous step.
4. Choose a random angle for the starting angle at which the first character of the quote will be printed.
5. Then write a loop to print the characters of the quote one-by-one, at equally-spaced increasing angles around the center point, starting with the first character of the quote at the starting angle. Use a `for`-loop, and make it count through the positions of the characters in the quote. Inside the loop, after each character is printed, increase the angle so that the next character is printed a bit further around the circle. Use the `charAt()` function to pick out one character of the `String` to print.

Use a canvas size of 600×600 . Use 30 pixels as the size of the letters. Make sure the background and letter colours contrast sufficiently that the quote is easy to read. Compute an angle speed so that the characters in the `String` are equally-spaced around the circle by dividing `TWO_PI` by the length of the `String`. Slow the frame rate down to something like 0.5 — using command `frameRate(0.5)`; so that the marker has time to read the quote during a frame before it is redrawn in the next frame.

Question 2: Printing in a Spiral

This question changes your program so that instead of printing a quote in a circle, it is printed in a spiral; see the example on the right.

Choose a longer quote than you used in Question 1 so that you get at least a couple of rotations to the spiral. The example uses the first line from “Pride and Prejudice” by Jane Austen. You can use that quote or choose another of a similar length.

Notice that the first character of the quote is on the outside of the spiral and the last character of the quote is on the inside of the spiral.

The quote must be printed from the inside of the spiral to the outside. So the *last* character of the quote must be the *first* letter you print in a frame, and the *first* character of the quote must be the *last* letter printed in the frame. So the `String` is printed in backwards order, one character at a time.

Save a copy of your original Question 1 program. You must hand in the original circle version, as well as this modified spiral version. Rename this copy so that it ends with `A3Q2`.

Here is what should happen in each frame:

1. Start with a fresh canvas.
2. In this question, always use the center of the canvas as the center of the spiral (not a random center).



3. Choose a random radius for the beginning of the spiral in the interior of the spiral. This starting radius can't be too small or the letters will be packed too tightly together to read in the interior of the spiral. The radius also can't be too big or the entire quote will not fit on the screen.
4. Choose a random angle to be angle at which the interior of the spiral begins.
5. Now you must write a for-loop that will print the entire quote in this frame:
 - Print the characters of the quote one-by-one in the loop — do this by making the for-loop count through the positions of the characters in the quote.
 - The loop must print the last character in the quote (the rightmost character) FIRST.
 - The loop must print the first character of the quote (the leftmost character) LAST.
 - That is, your loop must work backwards through the string (from right to left) — it is counting DOWN, not up.
 - The last character of the quote is printed at the starting point in the interior of the spiral.
 - Each subsequent character printed is printed at a slightly larger angle and a slightly larger radius than the previously-printed character.
 - In other words, inside the loop, after you print each character, you must increase the angle slightly and also increase the radius slightly.
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Choose the angle speed and the radius speed so that the characters in the quote are readable (not printed on top of each other).

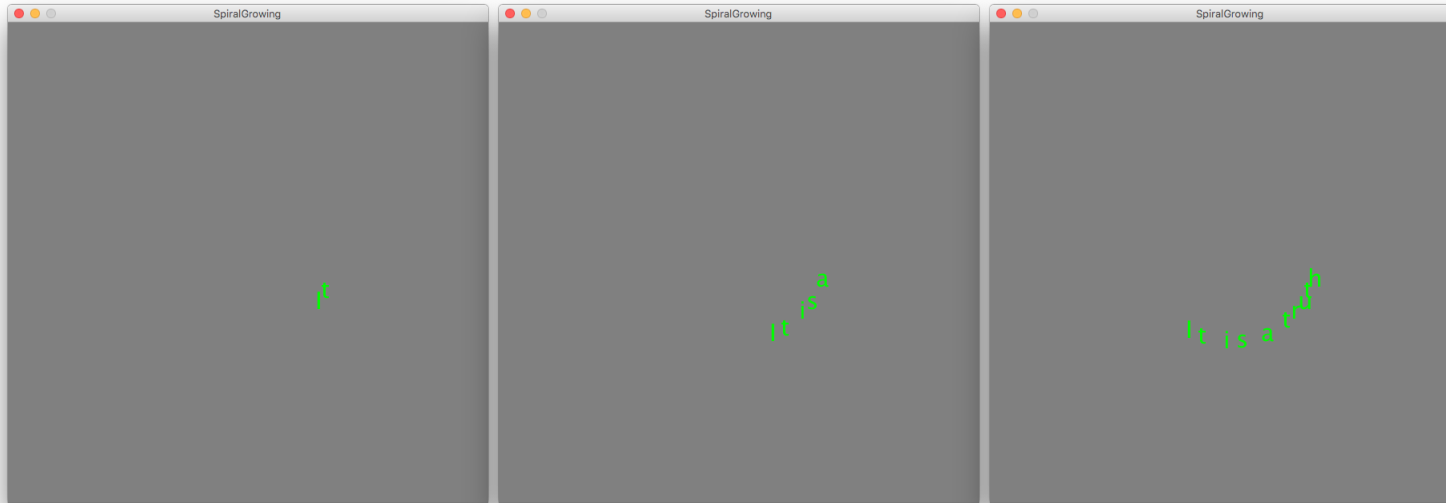
Remember that, in each frame, the *entire* quote is printed.

Use a canvas size of 600×600 . Use 30 pixels as the size of the letters. Make sure the background and letter colours contrast sufficiently that the quote is easy to read. Experiment with different radius and angle speeds until you find values so that make the characters in the `String` easily readable. Slow the frame rate down to something like 0.1 — using command `frameRate(0.1)`; so that the marker has time to read this longer quote during a frame before it is redrawn in the next frame.

What information needs to be remembered from frame to frame in this question — that is, what global / state variables do you need? Hint: few, if any!

Question 3: Letters coming out a Spiral

In this question, you will rewrite your program so that the long quote comes out in the spiral gradually, over many frames. For example, the pictures below show some snapshots of the execution of the sample solution; the left picture below shows the second frame drawn by the program, the middle picture shows the seventh frame, and the right picture shows the 13th frame.



When the program begins, you should choose a random angle and a random radius for the start of the spiral in its interior.

- In the first frame, only one character of the quote (the very first character) is printed, at the starting point of the spiral in its interior.
- In the second frame, two characters of the quote (the first and second characters) are printed, with the second one at the starting point in the spiral's interior and the first on a bit further out along the spiral. (This is what the left picture shows in the above example.)
- In the third frame, three characters of the quote (the first, second, and third) are printed, with the third one at the starting point in the interior and the second and first successively further out along the spiral.
- And so on, until the entire quotation is printed many frames later, with the last character at the starting point in the interior and the first character at the farthest point out along the spiral.

When the entire quote has been printed, start the whole process over again with a new random angle and new random radius for the interior starting point, printing just one character of the quote at the new starting point in the next frame.

So, in each frame, you are printing a part of the quote in a spiral — and printing that part backwards (last character first), just as you did in Question 2. The part of the quote to be printed increases by one character from frame to frame.

In this question, you need some global / state variables to remember the radius and angle of the starting point from frame to frame, and also to remember how many characters were printed in the previous frame, so that you can print one more character in the next frame.

You need to alter the loop that prints in a spiral so that it prints the correct number of characters in each frame, not the whole quote in every frame.

When you increase the number of characters to be printed in the next frame, you should check to see if that number has become larger than the number of characters in the quote. If it has, then you should reset it to 1, and generate a new random start angle and a new random start radius.

Use a canvas size of 600×600 . Use 30 pixels as the size of the letters. Make sure the background and letter colours contrast sufficiently that the quote is easy to read. Experiment with different radius and angle speeds until you find values so that make the characters in the `String` easily readable. Slow the frame rate down to something like 1 — using command `frameRate(1);` —, so that the text is coming out of the starting point slowly enough to be read.