National University of Singapore
School of Computing
CS1101S: Programming Methodology (JavaScript)
Semester I, 2012/2013

Mission 2
Rune Reading

Start date: 17 August 2012
Due: 23 August 2012, 23:59

Readings:

- Textbook Sections 1.1.1 to 1.1.4

Your instructors are pleased with your performance in the first mission. In this new mission, you are expected to demonstrate your investigative skills. Mastery of the Force is nothing without the ability to think and reason.

You need to open three doors, leading you another step closer towards the inner sanctum of the JFDI temple.

In Lecture 2, we demonstrated how JavaScript can be used to generate runes. Now, you get to try your hand at drawing them. You have been provided with matching pairs of HTML files and JavaScript template files. You should complete your tasks within the template files, and test them in their matching HTML files (You will need to refresh the HTML file if you make changes in the JavaScript file).

These HTML files load the `runes.js` script library. In each file, we defined the viewport (where your runes are going to be drawn) and the four runes discussed in class `rcross_bb`, `sail_bb`, `corner_bb`, and `nova_bb`. For example, you can display `rcross_bb` in the viewport with the following command in the Console:

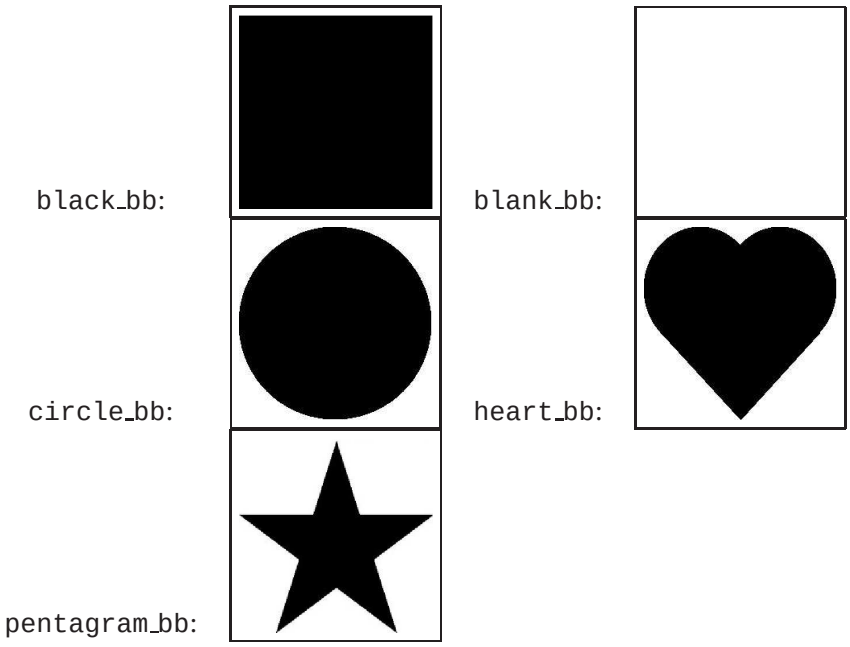
```
show(rcross_bb);
```

Don't forget to clear the viewport when necessary with `clear_all()`.

Also defined in `runes.js` are the following functions as discussed in class:

- `stack`
- `stack_frac`
- `quarter_turn_right`
- `eighth_turn_left`
- `flip_horiz`
- `flip_vert`
- `turn_upside_down`
- `quarter_turn_left`
- `beside`
- `make_cross`
- `repeat_pattern`
- `stackn`

In addition to the ones you saw in Lecture, we have also defined a few more basic runes that you can use:



In writing rather large, complex programs, one does not often understand (or even see) every single line of code, since such programs are usually written by several people, each in charge of smaller components. The key idea in functional abstraction is that as the programmer, you need not understand how each function works. All you need to know is what each function does and its signature (such as what parameters to pass). More specifically, **you need not read the code for the predefined functions listed above**. You may refer to the lecture slides to understand what arguments each function requires and its corresponding effect. Now we will use these functions as primitives building blocks to draw our own pictures.

This mission consists of **three** tasks.

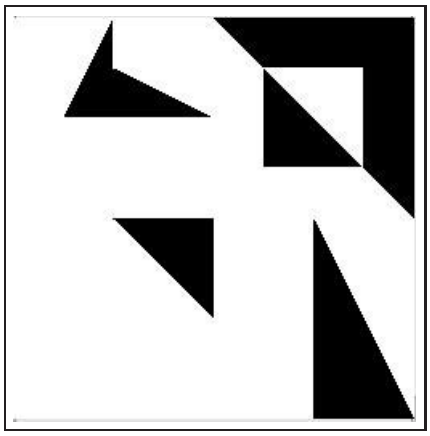
Task 1:

On the first door you find 4 basic runes and one complex rune separated by an empty space. Clearly, your task would be to fill in this space with a descriptive function for the manipulation of the 4 basic runes to create the complex one.

Write a function `mosaic` that takes four runes as arguments and arranges them in a 2×2 square, starting with the top-right corner, going clockwise. In particular, the command

```
show(mosaic(rcross_bb, sail_bb, corner_bb, nova_bb));
```

should draw the following:



Task Files

- lib/list.js
- lib/misc.js
- lib/graphics.js
- lib/runes.js
- mission_2_1.html
- **mission_2_1.js**

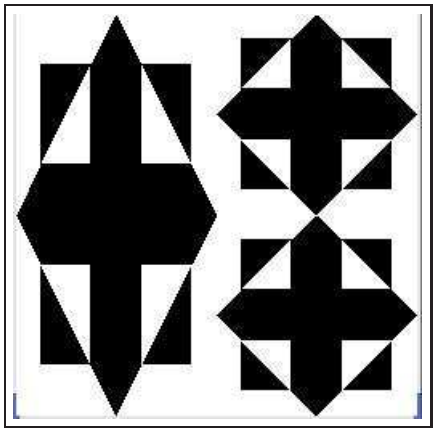
Task 2:

On the second door, you find 2 runes displayed in a similar fashion. The only difference would be that the complex rune now exhibits a different layout.

Write a function `simple_fractal` that takes as argument a rune and returns a rune consisting of the original rune and a pair of runes stacked on top of each other on its right. For example, the following command:

```
show(simple_fractal(make_cross(rcross_bb)));
```

should draw the following:



Task Files

- lib/list.js
- lib/misc.js
- lib/graphics.js
- lib/runes.js
- mission_2_2.html
- **mission_2_2.js**

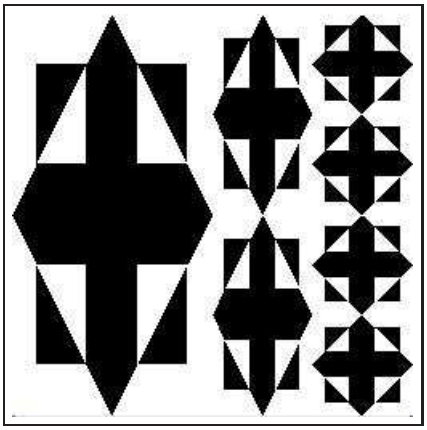
Task 3:

In the third and final door, you behold a similar sight to the previous door albeit with a slight difference. It will be well for you to comprehend the similarities and differences.

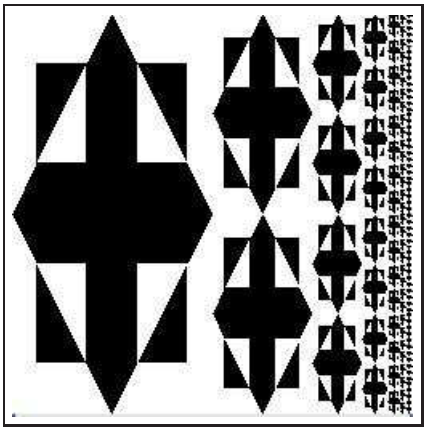
Write a function `fractal` that takes as arguments a rune and an integer $n > 0$. It should generate the rune below by means of a recursive process with the following command:

```
show(fractal(make_cross(rcross_bb), 3));
```

This should draw the following:



To determine that your function is correct for $n > 3$, check that the same command with $n = 7$ draws:



Task Files

- lib/list.js
- lib/misc.js
- lib/graphics.js
- lib/runes.js
- mission_2_3.html
- **mission_2_3.js**

Submission

To submit your work to the Academy, copy the contents from the template file(s) into the box that says "Your submission" on the mission page, click "Save Code", then click "Finalize Submission". Note that submission is final and that any mistakes in submission requires extra effort from a tutor or the lecturer himself to fix.