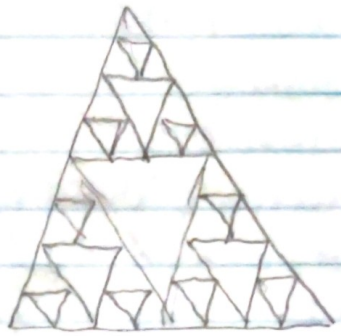
Sarah Cahoric (ok to post) Homework 28 4/22/2021

1.

```
                1
              1   1
            1   0   1
          1   1   1   1
        1   0   0   0   1
      1   1   0   0   1   1
    1   0   1   0   1   0   1
  1   1   1   1   1   1   1   1
```



It is a fractal because as you zoom in, you see the same pattern.

2. (i) $x_1 = 0.25$; $x_2 = 0.1875$; $x_3 = 0.152343375$; $x_4 = 0.1291351318$; $x_5 = 0.1124592496$; $x_6 = 0.0998126675$; $x_7 = 0.0898496981$; $x_8 = 0.0817767298$; $x_9 = 0.0750892963$; $x_{10} = 0.0694508939$

The limiting point is 0. The numbers continuously keep decreasing and getting closer to 0.

(ii) $x_1 = 0.625$; $x_2 = 0.5859375$; $x_3 = 0.6065368652$; $x_4 = 0.5966247409$; $x_5 = 0.6016591486$; $x_6 = 0.5991635437$; $x_7 = 0.6004164791$; $x_8 = 0.5997913269$; $x_9 = 0.6001042277$; $x_{10} = 0.5999478559$

I predict the limiting point is 0.6. Though it seems to be bouncing between two values, the two values are getting closer and closer to 0.6.

(iii) $x_1 = 0.775$; $x_2 = 0.5405625$; $x_3 = 0.7698995191$; $x_4 = 0.5491781737$; $x_5 = 0.7675026724$; $x_6 = 0.5531711928$; $x_7 = 0.7662357552$; $x_8 = 0.5552674202$; $x_9 = 0.7655310888$; $x_{10} = 0.5564290486$

It seems to be bouncing between two numbers, so I think the limiting points are 0.56 and 0.76.

(iv) $x_1 = 0.875$; $x_2 = 0.3828125$; $x_3 = 0.826934814 5$; $x_4 = 0.5008976$
948; $x_5 = 0.8749971795$; $x_6 = 0.3828199038$; $x_7 = 0.8269408837$;
$x_8 = 0.5008837959$; $x_9 = 0.8749972662$; $x_{10} = 0.3828196763$

It seems to be bouncing between 4 different values:
0.874, 0.38, 0.5, 0.83
I think the limiting points would be all 4 of those numbers.

3. The Feigenbaum constant is the ratio of the differences between k values in the equation $x_{n+1} = k\,x_n(1 - x_n)$ that leads to the doubling of the period. The constant is approximately 4.669...