CSE 13s

DESIGN for Assignment 2

October 7, 2021

0.1 Taylor Series

$$\frac{x}{k}$$

To calculate the approximation of e:

- halter = epsilon
- two functions: function e and e terms (return the number of computed terms)
- create variables: k (k will start @ 1), current term, previous term
- create while loop: while current term > epsilon current term = 1/k e += previous term x current term
  previous term = current term (set up for the next loop)
- return the approximation of e
- the terms will increment by 1 each time (tell us how many times it ran)

0.2 Bailey-Borwein-Plouffe

$$\sum_{k=0}^{n} 16^{-k}\left(\frac{4}{(8k+1)} - \frac{2}{(8k+4)} - \frac{1}{(8k+5)} - \frac{1}{(8k+6)}\right) \tag{1}$$

- two functions: function pi bbp and pi bbp terms (return the number of computed terms)
- create variables: k (k will start @ 0) and term
- create while loop: w/ epsilon pi += (4 / 8 * k + 1) pi -= (2 / 8 * k + 4)
  pi -= (1 / 8 * k + 5)
  pi -= (1/ 8 * k + 6) * term
  term /= 16
- return the approximation of pi
- the terms will increment by 1 each time (tell us how many times it ran)

0.3 Newton's Method of Square Root

To calculate the a square root:

- root formula = 0.5 * (x + (y/x)) x can be assumed to be y or x
- two functions: newton's function and newton iters
- create variables: x (set to as an input), sqrt, temp
- create while loop: loop only if abs(sqrt - temp) > epsilon temp = sqrt
  sqrt = 0.5 * (temp + x / temp)
- return approximation of the square root
- the terms will increment by 1 each time (tell us how many times it ran)

0.4 Euler's Solution

Finding the approximation of pi:

$$p(n) = \sqrt{6 \sum_{k=0}^{\infty} \frac{1}{k^2}} \tag{2}$$

- two functions: euler's function and euler terms
- create variables: n, k, pi
- create while loop: loop only if n > epsilon n = (1/k * 1/k) k += 1
  pi += n
  use newton's square root to determine 6 * pi
- return approximation of pi
- the terms will increment by 1 each time (tell us how many times it ran)

0.5 Madhava

1. Finding the approximation of pi:

$$\sum_{k=0}^{\infty} \frac{(-3)^{-k}}{2k+1} \tag{3}$$

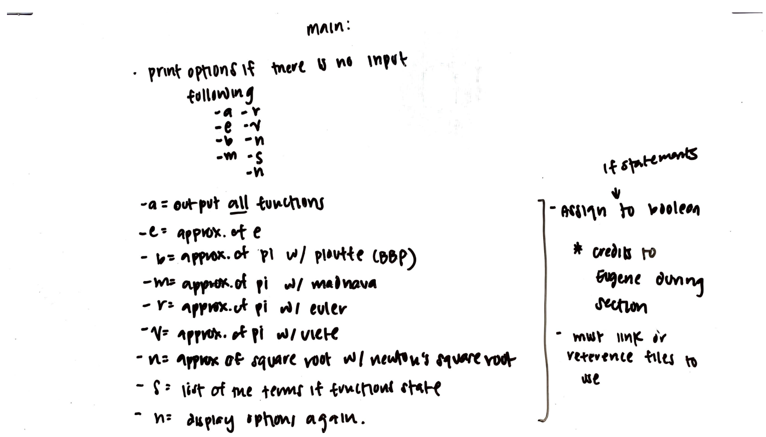

Figure 1: Diagram for the main

- two functions: madhava's function and madhava terms
- create variables: x, pi (x = 1), k
- create for loop (where k reaches close to 0)
- it will alternate between adding and subtracting because there is a (-1/3k)
- return the approximation of pi
- the terms will increment by 1 each time (tell us how many times it ran)

0.6 Viete

1. Finding the approximation of pi:

$$\prod_{k=1}^{\infty} \frac{a}{2} \tag{4}$$

   - two functions: viete pi function and viete terms
   - create variables: k, pi
   - create for loop (where k reaches close to 0)

- k = $\sqrt{2 + k} the terms will increment by 1 each time (tells us how many times it ran)$

0.7 MAIN Additional Diagrams

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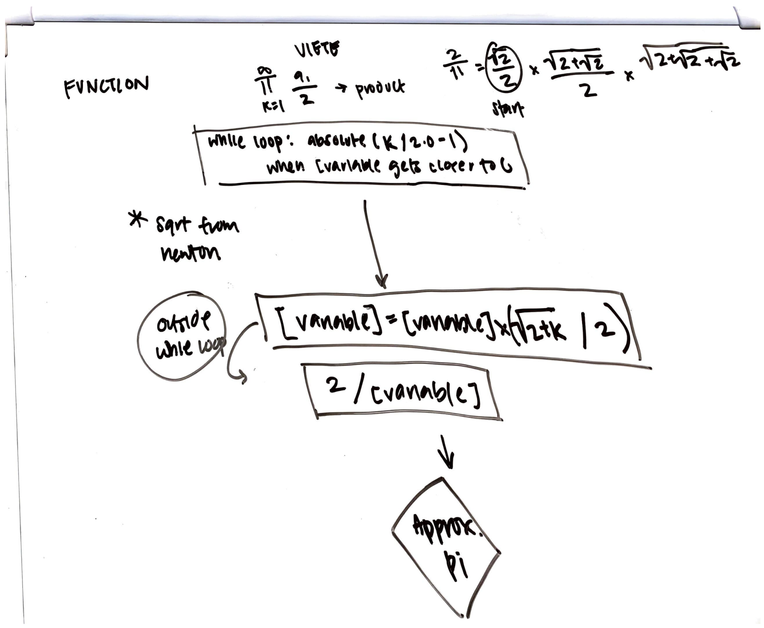

Figure 2: Diagram for approximating pi

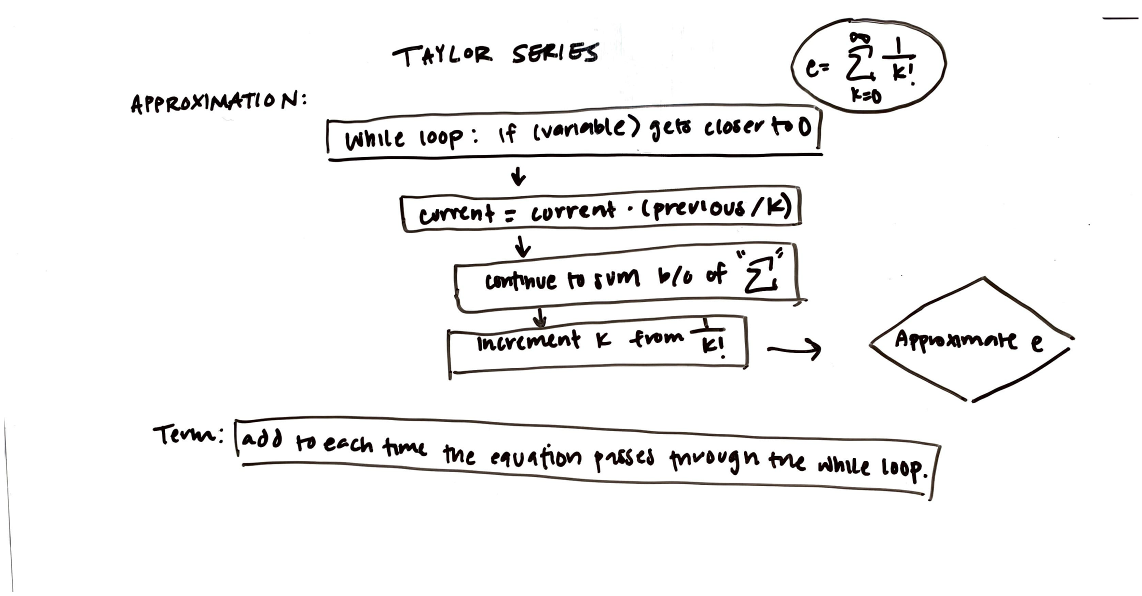

Figure 3: Diagram for approximating e

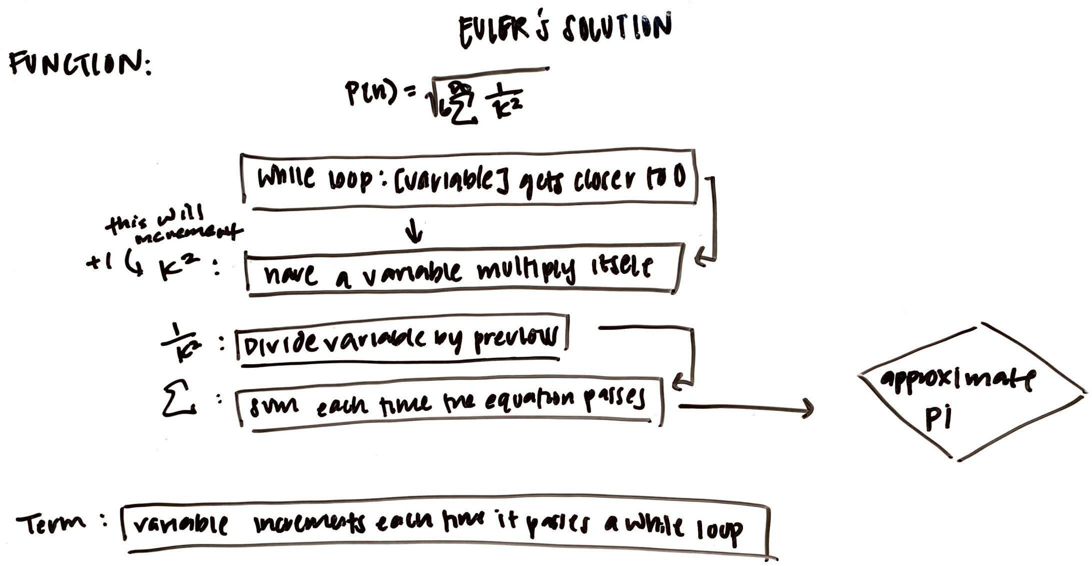

Figure 4: Diagram for approximating pi

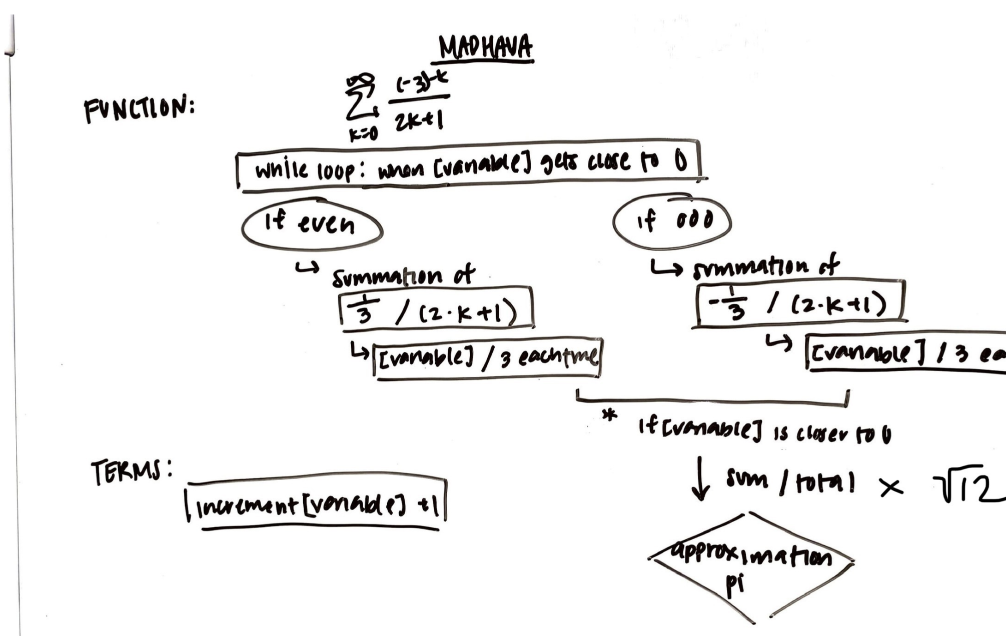

Figure 5: Diagram for approximating pi

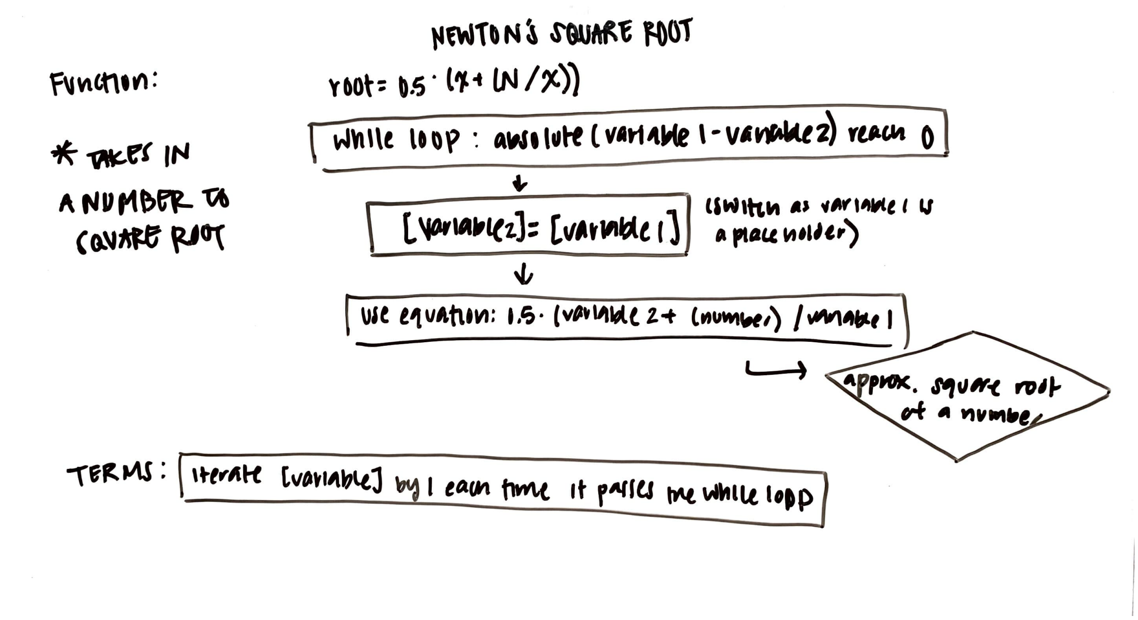

Figure 6: Diagram for approximating square root

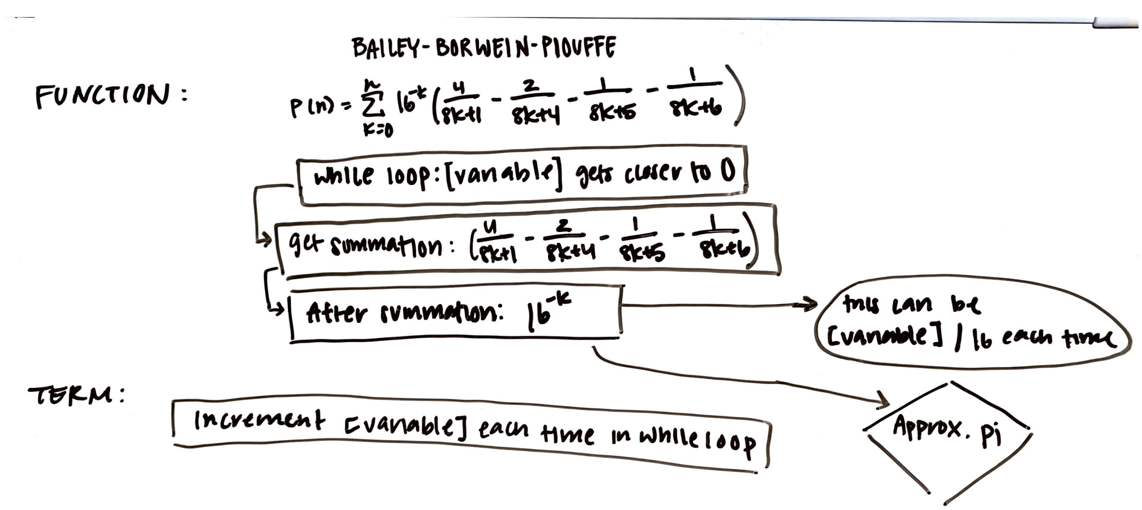

Figure 7: Diagram for approximating pi