1. (a) Given the ordered list 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233. Apply the binary search to locate the chosen number 89.

(b) Given the function \( f(x) = x^2 - x - 1 \). Apply 3 steps of binary search, or interval halving to locate the positive root of \( f(x) = 0 \).

Answer:

2. (a) Find and explain the order (complexity by big-\( \Theta \)) of the number of comparisons done in sorting a list of \( n \) elements.

(b) Show that \( 5x^4 - x^2 - 2 \) is \( \Theta(x^4) \).
3. (a) Use a *Greedy algorithm* to write $\frac{5}{7}$ as a sum of distinct unit fractions. (Namely, $\frac{5}{7} = \frac{1}{n_1} + \frac{1}{n_2} + \cdots + \frac{1}{n_k}$, where $n_i$’s are distinct positive integers and $k$ is minimal)

(b) Use a *Greedy algorithm* to write 141 as sum of distinct Fibonacci numbers defined by

$$f(n) = f(n-1) + f(n-2), \quad n \geq 2, \quad f(0) = 0, f(1) = 1.$$  

**Answer:**

4. (a) In how many ways can 20 oranges be distributed among 4 children?

(b) How many permutations of the letters in the word COMBINATORICS have no adjacent vowels (komşu sesli harf) ?

**Answer:**