QUESTIONS

1. Using set theory, define formally what is a function.

2. From set theory, define what is a power set.

3. Jenny will run an ice cream stand in the coming week-long event. She believes the fixed cost per day of running the stand is $60. Her best guess is that she can sell up to 250 ice creams per day at $1.50 per ice cream. The cost of each ice cream is $0.85. Find an expression for the daily profit, and hence find the break-even point (no profit–no loss point).

4. A stone is thrown upward so that at any time x (in second) after throwing, the height of the stone is $y = 100 + 10x - 5x^2$ (in meter). Find the maximum height reached.

5. For the continuous uniform distribution below, find its expected value.

$$f(x) = \begin{cases} \frac{1}{b-a} & \text{for } a \leq x \leq b, \\ 0 & \text{for } x < a \text{ or } x > b. \end{cases}$$

6. The following Python code implements the Selection Sort algorithm. Explain how it works.

```python
def selSort(L):
    """Assumes that L is a list of elements that can be
        compared using >.
    Sorts L in ascending order"""
    suffixStart = 0
    while suffixStart != len(L):
        #look at each element in suffix
        for i in range(suffixStart, len(L)):
            if L[i] < L[suffixStart]:
                #swap position of elements
                L[suffixStart], L[i] = L[i], L[suffixStart]
        suffixStart += 1
```

7. The previous algorithm has $O(N^2)$ time complexity (the input list size is N), but there are other more efficient sorting algorithms, like Merge Sort that has O(NlogN) time complexity. Please explain what time complexity means in practical terms.