Week 1 Hands-on Assignment Submission Theory

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Repository Link: <https://github.com/harini0403/Digital-Nurture-4.0-JavaFSE_Harini_Solutions>

Data Structures and Algorithms hand-son

*Exercise 2: E-commerce Platform Search Function - Theory*

**Big O Notation:**

Big O notation describes the upper bound of the time complexity of an algorithm as input size increases.

- O(1): Constant time.

- O(n): Linear time.

- O(log n): Logarithmic time.

- O(n^2): Quadratic time.

Linear Search Analysis:

- Best Case: O(1) (if found at first index)

- Average Case: O(n)

- Worst Case: O(n)

Binary Search Analysis:

- Best Case: O(1) (if found at middle)

- Average Case: O(log n)

- Worst Case: O(log n)

**Comparison:**

Linear Search:

•Does not require any prior ordering of data.

•Very simple to implement.

•Suitable for small datasets where overhead of sorting is not justified.

•Performance degrades linearly as dataset size grows.

•Can handle any type of data (numeric, string, complex objects) directly without preprocessing.

•Best suited when data changes frequently (insertions/deletions), as maintaining sort order may be costly.

Binary Search:

•Requires data to be sorted before performing search.

•Much faster for large datasets due to logarithmic time complexity.

•Efficient for static or rarely updated datasets where sort order can be maintained.

•Implementation is slightly more complex than linear search.

•Cannot be used directly on unsorted data without first sorting it, which adds O(n log n) overhead for sorting.

•Ideal for scenarios where many repeated searches are performed on relatively stable data.

Code Files (available in repository):

Product.java, LinearSearch.java, BinarySearch.java, SearchMain.java

*Exercise 7: Financial Forecasting - Theory*

**Recursion:**

Recursion is a method where a function calls itself with smaller subproblems until a base condition is met.

**Time Complexity:**

The recursion depth equals the number of years n. Time complexity is O(n).

**Optimization:**

For large datasets, recursion can be replaced with iteration to improve performance.

Code Files (available in repository):

FinancialForecasting.java