## Lecture 5 Algorithm Performance Analysis

1. What does Big-O notation represent?

- A) The exact runtime of an algorithm

- B) The upper bound of an algorithm's growth rate

- C) The lower bound of an algorithm's growth rate

- D) The average runtime of an algorithm

Answer: B

2. Which of the following complexities is the fastest for large input sizes?

- A) O(n^2)

- B) O(n \log n)

- C) O(n)

- D) O(\log n)

Answer: D

3. If an algorithm has a runtime of f(n) = 3n + 5, what is its Big-O complexity?

- A) O(1)

- B) O(n)

- C) O(n^2)

- D) O(\log n)

Answer: B

4. What is the best-case complexity for a linear search in an array?

- A) O(1)

- B) O(n)

- C) O(\log n)

- D) O(n^2)

Answer: A

5. Which notation represents the exact bound of an algorithm's growth rate?

- A) Big-O

- B) Big-Omega (\Omega)

- C) Big-Theta (\Theta)

- D) None of the above

Answer: C

6. Given a function g(n) = 2^n + n^2 + 100, what is its Big-O complexity?

- A) O(2^n)

- B) O(n^2)

- C) O(n \log n)

- D) O(1)

Answer: A

7. For a binary search, what is the worst-case time complexity?

- A) O(1)

- B) O(n)

- C) O(\log n)

- D) O(n^2)

Answer: C

8. Which of the following sorts has a worst-case complexity of O(n^2)?

- A) Merge Sort

- B) Quick Sort

- C) Selection Sort

- D) All of the above

Answer: C

9. What is the total complexity of this code snippet?

for (int i = 0; i < n; i++) {

for (int j = 0; j < n; j++) {

// O(1)

}

}

```

- A) O(n)

- B) O(\log n)

- C) O(n^2)

- D) O(1)

Answer: C

10. What does asymptotic analysis focus on?

- A) Exact runtime values for specific inputs

- B) Behavior as input size becomes very large

- C) Measuring time using a stopwatch

- D) Hardware-specific performance metrics

Answer: B

11. In the function below, what is the total time complexity?

```java

for (int i = 0; i < n; i++) {

for (int j = 1; j < n; j \*= 2) {

// O(1)

}

}

```

- A) O(n \log n)

- B) O(n^2)

- C) O(\log n)

- D) O(1)

Answer: A

12. What is the average-case complexity for searching for a letter in a word using linear search?

```java

boolean hasLetter(String word, char letter);

```

- A) O(1)

- B) O(\log n)

- C) O(n)

- D) None of the above

Answer: C

13. Which factor does NOT affect stopwatch-based timing analysis?

- A) Hardware platform

- B) Compiler optimizations

- C) Algorithm logic

- D) Input size scaling

Answer: D

14. For nested loops where the outer loop runs in n, and the inner loop runs in \log n, what is the total complexity?

```java

for (int i = 0; i < n; i++) {

for (int j = 1; j < n; j \*= 2){

// O(1)

}

}

```

- A) O(n \log n)

- B) O(n^2)

- C) O(\log n^2)

- D) None of the above

Answer: A

15. Which is true about an algorithm’s average-case complexity?

- A) It must be equal to best-case complexity.

- B) It must be equal to worst-case complexity.

- C) It lies between best-case and worst-case complexities.

- D) It cannot be determined without more information.

Answer: C