## Lecture 7-hash table

1. What is the primary advantage of using a hash table?

a) Sorted data storage

b) Fast access time

c) Memory efficiency

d) Easy implementation

Answer: b) Fast access time

2. In Java, which method is inherited by all classes to generate a hash code?

a) getHashCode()

b) createHash()

c) hashCode()

d) generateHash()

Answer: c) hashCode()

3. What is the ideal goal of a hash function?

a) To produce a unique index for each key

b) To minimize collisions

c) To scramble keys uniformly and produce equally likely table indices

d) To maximize memory usage

Answer: c) To scramble keys uniformly and produce equally likely table indices

4. Which of the following is NOT a method for handling collisions in a hash table?

a) Linear probing

b) Separate chaining

c) Quadratic probing

d) Binary search

Answer: d) Binary search

5. What is the time complexity of accessing an element in a hash table under ideal conditions?

a) O(1)

b) O(log n)

c) O(n)

d) O(n^2)

Answer: a) O(1)

6. In Java's String class implementation of hashCode(), what prime number is used in the calculation?

a) 17

b) 23

c) 31

d) 37

Answer: c) 31

7. What is the purpose of modular hashing?

a) To encrypt the hash code

b) To convert the hash code to an array index

c) To eliminate collisions

d) To compress the original key

Answer: b) To convert the hash code to an array index

8. Which of the following is a correct implementation of modular hashing in Java?

a) return key.hashCode() % M;

b) return Math.abs(key.hashCode()) % M;

c) return (key.hashCode() & 0x7fffffff) % M;

d) return key.hashCode() / M;

Answer: c) return (key.hashCode() & 0x7fffffff) % M;

9. What is primary clustering in hash tables?

a) When all keys hash to the same index

b) When keys are stored in sorted order

c) The tendency to create long runs of filled slots near the hash position of keys

d) When the hash table is completely full

Answer: c) The tendency to create long runs of filled slots near the hash position of keys

10. What is the recommended load factor for resizing a hash table?

a) 50%

b) 70%

c) 80%

d) 90%

Answer: b) 70%

11. Which of the following is NOT a method to mitigate primary clustering?

a) Better-designed hash function

b) Alternative probing methods

c) Resizing the hash table

d) Using a binary search tree

Answer: d) Using a binary search tree

12. In separate chaining, what data structure is typically used to handle collisions?

a) Array

b) Linked list

c) Binary tree

d) Stack

Answer: b) Linked list

13. What is the main advantage of linear probing over separate chaining?

a) Easier implementation

b) Better cache performance

c) Less sensitive to poorly-designed hash functions

d) Faster deletion operations

Answer: b) Better cache performance

14. Which method is used to compute the hash code for Boolean values in Java?

a) Return the memory address

b) Return a constant value

c) Return two large prime numbers based on the boolean value

d) XOR the boolean value with a prime number

Answer: c) Return two large prime numbers based on the boolean value

15. What is the purpose of caching the hash value in Java's String class implementation?

a) To reduce memory usage

b) To improve performance by avoiding recalculation

c) To ensure uniqueness of hash codes

d) To simplify the hash function

Answer: b) To improve performance by avoiding recalculation

16. Which of the following is a challenge when implementing a delete operation in linear probing?

a) Finding the element to delete

b) Maintaining the integrity of the probe sequence

c) Resizing the hash table

d) Updating the hash function

Answer: b) Maintaining the integrity of the probe sequence

17. What is the main disadvantage of using separate chaining?

a) Poor cache performance

b) Difficulty in implementation

c) Higher memory usage

d) Slower insertion operations

Answer: a) Poor cache performance

18. In Java, what should be done when overriding the equals() method?

a) Nothing, it's not necessary to change hashCode()

b) Always return a constant value from hashCode()

c) Override hashCode() to maintain the contract that equal objects have equal hash codes

d) Remove the hashCode() method entirely

Answer: c) Override hashCode() to maintain the contract that equal objects have equal hash codes

19. What is double hashing?

a) Using two separate hash tables

b) Applying a second hash function when a collision occurs

c) Hashing a key twice with the same function

d) Using two different hash functions for keys and values

Answer: b) Applying a second hash function when a collision occurs

20. What is the purpose of using prime numbers in hash functions?

a) To increase the speed of calculations

b) To reduce memory usage

c) To improve the distribution of hash codes and reduce collisions

d) To simplify the implementation of the hash function

Answer: c) To improve the distribution of hash codes and reduce collisions