

University Computer Science

Name: _____ Score: _____

1. The class of $3n^2 + 5n + 7$ is –
 - ☐ $\Theta(n^2)$
 - ☐ $O(n^3)$ only
 - ☐ $\Theta(n)$
 - ☐ $\Theta(n \log n)$
2. Index number i in a contiguous array costs –
 - ☐ one computed address, $O(1)$
 - ☐ a hash lookup
 - ☐ a walk from the head, $O(n)$
 - ☐ a sort
3. Under $h(k) = k \bmod 13$, the keys 4, 17, 30, 43 all land –
 - ☐ no bucket
 - ☐ bucket 4
 - ☐ bucket 13
 - ☐ distinct buckets
4. In a heap stored as an array, the children of index i sit at –
 - ☐ $i+1$ and $i+2$
 - ☐ $2i$ and $2i+1$
 - ☐ $2i+1$ and $2i+2$
 - ☐ $i-1$ and $i//2$
5. Ten undirected edges need – adjacency-list entries
 - ☐ 64
 - ☐ 100
 - ☐ 20
 - ☐ 10
6. Any sort that only swaps adjacent pairs makes, on a dataset, exactly – swaps
 - ☐ $n \log n$
 - ☐ the inversion count

☐ random

☐ n

7. Binary search requires –

☐ unique keys only

☐ a hash table

☐ sorted data

☐ a balanced tree

8. Halving the input each step touches –

☐ $\log n$ levels

☐ constant levels always

☐ n levels

☐ the square root of n levels

9. Append at the end of a Python list is –

☐ amortized $O(1)$ by doubling

☐ $O(n \log n)$

☐ $O(\log n)$

☐ $O(n)$ always

10. Seven keys in thirteen buckets give a load factor of –

☐ 7

☐ 13

☐ 0.54

☐ 1.86

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1. $\Theta(n^2)$

Drop constants and lower-order terms; the n squared term eats the rest.

2. **one computed address, $O(1)$**

The cells sit side by side: the address is computed, not searched for.

3. **bucket 4**

Each key leaves remainder 4 on division by 13 – one crowded bucket.

4. **$2i+1$ and $2i+2$**

The complete shape fixes the mapping: left child $2i+1$, right child $2i+2$.

5. **20**

Each undirected edge is stored twice, once per endpoint.

6. **the inversion count**

Each adjacent swap fixes exactly one inversion – the count is the bill.

7. **sorted data**

The halving argument collapses on unsorted data – wrong answers, silently.

8. **$\log n$ levels**

Each halving is one step: 16 items resolve in 4 probes because 2 to the 4th is 16.

9. **amortized $O(1)$ by doubling**

Doubling regrows copy each element at most once overall, so the average append is constant.

10. **0.54**

Alpha is keys over buckets: $7/13$ is about 0.54 – also the average chain length.