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 mod 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

   ☐ 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

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.