

**Question 1. (8 points)**  $O(n^3 \log n)$ ,  $O(n^2)$

**Question 2. (6 points)** 26, 36, 17, 115, 40, 87

**Question 3. (8 points)** T, F, F, F

**Question 4. (18 points)**

1. (5 points)

a: 1, b: 9, c: 2, d: 7, e: 4, f: 5, g: 3, h: 8, i: 6, j: 10.

2. (4 points)  $(b, h)$ ,  $(d, i)$

3. (4 points)  $g$ ,  $h$ ,  $d$ ,  $i$

4. (5 points)

a: 1, b: 10, c: 2, d: 5, e: 6, f: 7, g: 4, h: 8, i: 3, j: 9.

**Question 5. (8 points)**

- Select the  $(\log n)$ th smallest item (call it  $x$ ) using the linear-time selection algorithm we presented in class. Then go through  $S$  collecting the  $\log n$  items that are  $\leq x$ . This step takes linear time.
- Sort the  $\log n$  items collected in Step 1: The  $k$ th item in this small sorted list is the  $k$ th smallest item in  $S$ . This step takes  $O(\log n \log \log n)$  time, so the total time is linear.

**Question 6. (6 points)** Choice 2

**Question 7. (6 points)**

- (3 points)  $T(n) = c_1$  if  $n \leq 30$ , otherwise  $T(n) = T(2n/3) + c_2$ .
- (3 points) Solution is  $O(\log n)$ .

**Question 8. (5 points).** Choice 1

**Question 9. (12 points)** F, F, T, F

**Question 10. (6 points)** T, T

**Question 11. (10 points)**

1. (6 points)  $2^k$
2. (4 points)  $\log n$

**Question 12. (7 points)**  $pre[u] < pre[w]$  and  $post[u] > post[w]$