Solutions

2.1

- $[1, 3, 8, 5]$ ✓.
- 3 sifted over 5; 1 over 5 then 3; 8 stayed ✓.

2.2

- The leftmost node of the right subtree ✓.

2.3

- Children of $i = 2$: indices 5 and 6 ✓.

3.1

- Tree: 50 root; 30, 70 level 1; 20, 40, 60, 80 level 2 – height 2 ✓.
- Search 40: 50 (left), 30 (right), 40 – 3 comparisons ✓.
- Search 45: 50, 30, 40 then a null right link ($45 > 40$) – 3 comparisons, absent ✓.
- After inserting 35 (left child of 40), inorder reads $20, 30, 35, 40, 50, 60, 70, 80$ ✓.
- Sorted insertion builds a chain of height 6 ✓.

3.2

- `heappush(2)` lands at index 4 (next free slot) ✓.
- Sift-up: swap with 5 (index 1) $\rightarrow [1, 2, 8, 5, 3]$; check parent 1 at index 0: $1 \leq 2$, stop ✓.
- Final array $[1, 2, 8, 5, 3]$ – parents $1 \leq 2, 8$; $2 \leq 5, 3$ ✓.
- `heappop` removes index 0 (value 1); the last element 3 moves to the root ✓.
- One sift-down against the smaller child 2: swap $\rightarrow [2, 3, 8, 5]$ ✓.