

## 1 QuickSort

See the source code file `quickSort.cpp` and the tests given in `tests.cpp`. No written response is needed for this part of the lab.

## 2 Big-O Proofs

**Problem 1.** Show that  $8n^3 + 7n^2 - 12$  is  $O(n^3)$ .

Assume that  $n$  is an integer and  $n > 0$

$$8n^3 \leq 8n^3$$

$$7n^2 \leq 7n^3$$

$$-12 < 0$$

$$8n^3 + 7n^2 - 12 \leq 8n^3 + 7n^3 = 15n^3$$

$$n_o = 1$$

Therefore  $f(n)$  is  $O(n^3)$  when  $n_o = 1$  and  $c = 15$

**Problem 2.** Show that  $6n^2 - n + 4$  is  $O(n^2)$ .

Assume that  $n$  is an integer and  $n > 0$

$$6n^2 \leq 6n^2$$

$$-n < 0$$

$$4 \leq 4n^2$$

$$6n^2 - n + 4 \leq 6n^2 + 4n^2 = 10n^2$$

$$n_o = 1$$

Therefore  $f(n)$  is  $O(n^2)$  when  $n_o = 1$  and  $c = 10$

## 3 Mystery Functions

$\text{fnA}(n)$  big-O:  $O(n)$

$$n/2 \leq n$$

$\text{fnB}(n)$  big-O:  $O(n^2)$

$$n^2 \leq n^2$$

$\text{fnC}(n)$  big-O:  $O(n \log(n))$

$$n \log(n) \leq n \log(n)$$

$\text{fnD}(n)$  big-O:  $O(n^4)$

$$n^2 * n^2 \leq n^4$$

$\text{fnE}(n)$  big-O:  $O(1)$

$$4 \leq 4 * 1, c=4$$

$\text{fnF}(n)$  big-O:  $O(n^3)$

$$n^3 \leq n^3$$

From fastest to slowest: E, A, C, B, F, D