

Computer Science Department,  
College of Computer and Information Sciences,  
King Saud University.

CSC 311  
The Second Semester, 2020/2021  
Homework #1  
Due on February 14, 2021.

---

**Q1:** Using the definition of  $\Theta$ , give a formal proof for:  
 $0.5n^3 - 4n^2 + 2 \in \Theta(n^3)$ .

**Q2:** Give a formal proof for:  
 $f(n) \in O(g_1(n))$  and  $h(n) \in O(g_2(n)) \Rightarrow f(n) + h(n) \in O(\text{MAX}(g_1(n), g_2(n)))$ .

**Q3** (*Q5, Section 2.3 in the Textbook*): Order the following functions according to their order of growth (from the lowest to the highest):  
 $(n-2)!$ ,  $5 \lg(n+100)^{10}$ ,  $2^{2n}$ ,  $0.001n^4$ ,  $3n^3 + 1$ ,  $\ln^2 n$ ,  $\sqrt[3]{n}$ ,  $3^n$ .

**Q4:** What is the time complexity of the following algorithm? Find the operation count as a function of the input size and a tight  $O$  estimate (you don't need to give a formal proof for the  $O$  estimate).

---

**Algorithm 1:** Y Algorithm

---

```
Y Algorithm( $A[0..n-1]$ )
  for  $i:=0..\lfloor \frac{n}{2} \rfloor - 1$  do
    for  $j:=i..n-1$  do
       $A[j] := A[j] + A[i]$ ;
    end
  end
end
```

---