University of Waterloo
CS240 Fall 2025
Assignment 1 Post-Mortem

Question 1   [3+3+3+3+3=15 marks]

- This question was generally well done.

- Some students did not explicitly give c_1, c_2, n_0 for part (c). While you may use previous results, this is required for proofs from first principles (as n_0 may change with 2 separate inequalities to satisfy).

- Some students attempted to use limit rule for parts (d) and (e). For proofs from first principles, this is not an accepted method.

Question 2   [4+4=8 marks]

- This question was generally well done.

- Several students attempted to apply limit rule on part (b). Limit rule can only be applied if the limit exists for $\lim_{n \to \infty} \frac{f(n)}{g(n)}$. Such a limit does not exist here.

Question 3   [6+6=12 marks]

- Many students attempted to apply limit rule for both parts of the question. Limit is not guaranteed to exist for this question.

- For part (a), some students attempted to apply limit rule on only odd n or even n. This is not a correct application of the limit rule.

- For part (a), some students did not properly negate the definitions of order notations. For example, $f(n) \notin o(g(n))$ should be $\exists c > 0, \forall n_0 \geq 0, \exists n \geq n_0, \quad s.t. \quad f(n) > cg(n)$ by definition.

Question 4 [6 marks]

- This question was very well done.

- Some students missed a +1 on the exponent of r in the case $\Theta \neq 2$

- Some students incorrectly used the case for $r > 1$ to solve the geometric sequence in the case $\Theta \neq 2$

- Some students missed a +1 in the case $\Theta = 2$

Question 5 [2+2+4+4=12 marks]

- Parts (a), (b), and (c), were generally very well done.

- For part (d), some students forgot to include the case where calls to print was $n + 1$ in their analysis.

- For part (d), many students solved the summation incorrectly.

Question 6 [5 marks]

- This question was generally well done.

- Errors in this question were mostly individual. They mainly stemmed from lack of rigor in proofs.

Question 7 [5 marks]

- This question was very well done.

- Some students only provided an upper bound. The question asks for a Θ bound so both an upper and lower bound must be provided. Alternatively, you can maintain equality throughout your solution.

- Many students counted loop iterations 1 less than the correct value. No marks were deducted in these cases but it is important to be careful.