CS 173, Summer 19 Examlet 10

Name:____

NetID:____________________ **Lecture:** **A**

Discussion: **Monday & Wednesday** **1:30** **2:30**

(15 points) Use (strong) induction to prove the following claim:

Claim: $\frac{(2n)!}{n!n!} < 4^n$, for all integers $n \geq 2$

Proof by induction on n.

Base case(s):

Inductive Hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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1. (7 points) You found the following claim on a hallway whiteboard. Suppose that f and g are increasing functions from the reals to the reals, for which all output values are > 1. If $f(x)$ is $O(g(x))$, then $\log(f(x))$ is $O(\log(g(x)))$. Is this true? Briefly justify your answer.

2. (8 points) Check the (single) box that best characterizes each item.

$T(1) = d$
$T(n) = 2T(n-1) + c$

$\Theta(\log n)$ ☐	$\Theta(\sqrt{n})$ ☐	$\Theta(n)$ ☐	$\Theta(n \log n)$ ☐
$\Theta(n^2)$ ☐	$\Theta(n^3)$ ☐	$\Theta(2^n)$ ☐	$\Theta(3^n)$ ☐

$T(1) = d$
$T(n) = T(n-1) + n$

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$n^{1.5}$ is $\Theta(n^{1.414})$ ☐ $O(n^{1.414})$ ☐ neither of these ☐

Suppose $f(n)$ is $\Theta(g(n))$.
Will $g(n)$ be $O(f(n))$? no ☐ sometimes ☐ yes ☐