Last Name:_____ **First Name:**_____

- **CMPUT 204 Quiz 1, Version B** (45 minutes)
- Put your name above and your ID on the succeeding pages.
- There are 3 questions, in total 50 marks.
- Closed Book.
- Use space below the questions to write your answer.

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1. Indicate, for each pair of expressions $h(n)$ and $f(n)$ in the table, if $h(n)$ is an element of O, o, Ω, ω, or Θ of $f(n)$. Your answer should be written into the table by writing "yes" or "no" in each box. Assume $c > 1$. The first row is done for you. **Below the table either prove or disprove your answer for $\Omega(\cdot)$ for the functions listed in the final row, (d).**

	$h(n)$	$f(n)$	O	o	Ω	ω	Θ
Ex.	$3n^2$	$6n \lg n$	no	no	yes	yes	no
(a)	n^2	$n(\lg n)^4$					
(b)	3^n	2^{2n}					
(c)	$c^{\lg n}$	$n^{\lg c}$					
(d)	$2^{n \lg n}$	$(3+c)^n$					

ID:_____

2. Below is pseudocode for a procedure to return the smallest element in an array. Use a loop invariant to prove the procedure is correct.

```
MAXIMUM(A)
1  max ← A[1]
2  for i ← 2 to length[A]
3        do if max < A[i]
4              then max ← A[i]
5  return max
```

ID:_____

3. Suppose you wanted to maintain an array where elements could be added to the array and the array was kept in sorted order, so that the smallest element would always be at the front of the array. This is the essence of what is called a *priority queue*, which we'll look at more next week.

   (a) Using INSERTION-SORT(A) as a subroutine, write pseudocode for the INSERT(A, i) procedure which should add element i to the array A.

   (b) In θ-notation what is the worst-case running time of your INSERT(A, i) when A initially contains n elements?

   (c) What would the worst-case running time be if MERGE-SORT were used in place of INSERTION-SORT?