MAT2440 Practice Final Exam Halleck Spring 201 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Book and notes are prohibited except for a single sheet (back and front) with hand-written formulae/notes. Submit formula sheet with your exam for up to 5 extra pts.
* You may write on test page. However, put all your work and answers into the blue book.
* No credit will be given for any answer that is not backed up with work.
* The use of any electronic devices except a graphing calculator is strictly prohibited.

The review is essentially a selection of earlier exam questions plus some from section 5.1.

1. Let C(x, y) be the statement “x finds y charming," where the domain for x and y consists of all people in the world. Use quantifiers to express each of the following statements.
	1. [5 pts] Everyone finds themselves charming.
	2. [5 pts] Someone finds Jerry charming.
	3. [5 pts] There is a person that finds everyone charming.
	4. [5 pts] If you find Max charming, then you will also find Gina charming.
2. Answer each of the following questions.
	1. [5 pts] Show that p ® q is logically equivalent to Ø q ® Ø p using a truth table.
	2. [5 pts] Show that Ø p ® (q ® r) º q ® (p Ú r) without using a truth table.
	3. [5 pts] Show that Ø (p ® q) ® Ø q is a tautology without using a truth table.
3. [15 pts] Prove that for all integers n, n is even if and only if 5n + 3 is odd.
4. Answer each of the following questions.
5. [10 pts] Find an expression for the negation of this statement. All negation symbols must immediately precede predicates.

∃x ∀y (Q(x, y) ® P (x, y))

1. [5 pts] The domain of x and y is **Z+**, the set of positive integers. Determine if the following statement is true or false and justify your answer. (Hint: solve for y.)

∀x ∃y (xy = y2)

1. Translate the following specifications into English where:

F(p): “printer p is out of service"

B(p): “printer p is busy"

Q(j): “print job j is queued”

(a) [5 pts] ∃j Q(j) ® ∃p (F(p) Ú B(p))

(b) [5 pts] ∀j Q(j) ® ∀p F(p)

NOTE: assume that a print job that is being processed is no longer queued.

1. (a)[6 pts] Determine cardinality of the set A= $\{∅,\left\{a\right\}, \left\{∅,a\right\}\}$ as well as each member of set A.

(b) [6 pts] Draw the Venn diagram for the following combination of the sets A, B, and C.

$A∩(B-C)$ (shade *A* and $B-C$ as intermediate steps and use a legend)

1. [7 pts] Is it true that $A∪\left(B-A\right)=A∪B$? Use a truth table.
2. Determine if the following functions are 1-1 and/or onto.

(a) [8 pts] $f:R\rightarrow R, f\left(x\right)=3x^{3}-2$

(b) [8 pts] $g:R\rightarrow Z, g\left(x\right)=\left⌊x/2\right⌋+6$

1. [8 pts] Use bubble sort to sort 2, 6, 1, 4, 3, 5, showing the list obtained after each pass. At each step, underline the pair of adjacent elements being considered for transposition.
2. (a) [10 pts] Using a for loop, write the pseudocode for an algorithm that takes in a list of *n* integers and returns the count of integers in the list that are < 3 or > 8.

(b) [10 pts] Using a while loop, write pseudocode for an algorithm that finds the location of the 2nd integer strictly bigger than *x* given a list of *n* integers or outputs 0 if there is no such integer.

1. [5 pts] Show that $A=\left\{0, 1, 2, 3\right\}×N$ is countably infinite by drawing a 4-row listing of the set and exhibiting a path which will systematically visit each element.
2. [8 pts] Find an expression for the sum$ \sum\_{j=1}^{500}3j-1$ without using technology.
3. [9 pts] What is effect in time required to solve a problem when you increase the size of input from *n* to *n* + 1, assuming that #milliseconds algorithm uses to solve problem with input size *n* is each of these functions? Use a difference to determine answer:

a. log *n* b. 2*n* c. *n*4

1. [6 pts] What is the effect in time required to solve a problem when you increase the size of input from *n* to *n* + 1, assuming that #milliseconds algorithm uses to solve problem with input size *n* is each of these functions? Use a ratio to determine answer:

a. 3*n* b. (2*n*)!

1. [8 pts] The ISBN-10 of *Mathematical Modeling and Computer Simulation* is 0-534-Q8478-1, where *Q* is a digit. Find the value of *Q*.
2. [10 pts] Encrypt MY BIRTHDAY IS TOMORROW by translating letters into #s, using  *f* (*p*) = (7*p* + 13)**mod** 26, & then translating #s back into letters.
3. (a) [4 pts] Find a formula for $\frac{1}{1∙2}+\frac{1}{2∙3}+\cdots +\frac{1}{n(n+1)}$ by examining the values of this expression for small values of n.

(b) [6 pts] Prove the formula you conjectured in part (a).

1. [6 pts] Prove that $3^{n}<n!$ if *n* is greater than 6.

This practice exam has 200 pts associated with it. The actual exam will consist of similar problems with point assignments such that the points total 100.