MAT2440 Practice Final Exam Halleck Spring 2019 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.
* Each problem is worth 10 points (Some of the problems on the actual exam will have fewer parts)
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. Everyone finds themselves charming.
	2. Someone finds Jerry charming.
	3. There is a person that finds everyone charming.
	4. If you find Max charming, then you will also find Gina charming.
2. Answer each of the following questions.
	1. Show that p ® q is logically equivalent to Ø q ® Ø p using a truth table.
	2. Show that Ø p ® (q ® r) º q ® (p Ú r) without using a truth table.
	3. Show that Ø (p ® q) ® Ø q is a tautology without using a truth table.
3. Prove that for all integers n, n is even if and only if 5n + 3 is odd.
4. 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) ∃j Q(j) ® ∃p (F(p) Ú B(p)) (b) ∀j Q(j) ® ∀p F(p)

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

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

(b) 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)

(c) Is it true that $A∩\left(B-C\right)=(A∩B)-\left(A∩C\right)$? Use a truth table.

1. Determine if the following functions are 1-1 and/or onto:

(a) $f:Z\rightarrow Z, f\left(x\right)=3x^{3}-2$

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

1. Use insertion sort with input 2, 6, 1, 4, 3, 5, showing as separate steps the comparisons, rotations and insertions. You should have approximately 6+5+4+3+2+1 steps, each showing all or a portion of the list.
2. The ISBN-10 of *Mathematical Modeling and Computer Simulation* is 0-534-Q8478-1, where *Q* is a digit. Find the value of *Q*. Use the Euclidean Algorthm (EA) to find the appropriate inverse.
3. If encryption function is *f* (*p*) = (7*p* + 13)**mod** 26, decrypt TZURCQKIDB: translate letters into #s, apply appropriate decryption function (use EA to find inverse of 7) & then translate #s back into letters.
4. Choose ONE of the following 2 INDUCTION proof problems:

(i)(a) Find formula for $\frac{1}{1∙2}+\frac{1}{2∙3}+\cdots +\frac{1}{n(n+1)}$ by examining values of this expression for small values of n

 (b) Prove the formula you conjectured in part (a).

(ii) Prove that $3^{n}<n!$ if *n* is greater than 6.