Final

April 26, 2000

Name: ______________________________

COMPUTING SCIENCE 272 (B1)

FINAL EXAM
(Winter 2000)

Instructor: John Willson

I.D.# ____________________

TIME: 120 Minutes

LAST NAME: ____________________ FIRST NAME: ____________________

SIGNATURE: ______________________________

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CMPUT 272 (B1)
WILLSON, J.
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PAGES: 11

TOTAL MARKS: 100 Marks

INSTRUCTIONS:

- **Please do not open exam until instructed to do so.**
- **No calculators are allowed; however, notes, and the text are allowed.**
- **No discussions during the exam are allowed. This is individual work only.**
- **Show all work for partial marks.**
- **Make sure there are 10 questions.**
- **If you require more work paper than the back of the pages, then ask for an examination book and state where your answers are.**
- **If there are multiple answers to a question do one answer and mention the other.**

1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10
	100

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1. **(10)** Using logical reasoning, prove or disprove the following " Of all the rectangles with a given perimeter, the square has the greatest area". (Hint: You do not have to put this question in terms of propositional, predicate, and/or set theoretic logic)

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2. (10) Consider the connective $\downarrow$ called the joint denial with $p \downarrow q$ being read as " Neither p nor q". Construct the truth table for this connective and prove that the standard three connectives: $\neg$, $\wedge$, and $\vee$ can be expressed in terms of the $\downarrow$ connective. Finally prove the contra-positive of $p \rightarrow q$ using the $\downarrow$ connective.

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3. (10) Use the laws of Table 2.4 and propositional logic to derive

$$\exists x P(x) \wedge \forall x \forall y (P(x) \wedge P(y)) \Rightarrow (x = y)$$

from

$$\exists x (P(x) \wedge \forall y (P(y) \Rightarrow (x = y)))$$

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4. **(10)** Symbolize, then justify using Predicate Logic, the following reasoning. "None of the primes are integrally divisible by an even integer greater than 2; any of the primes is integrally divisible by the number 1; there exist some primes; therefore, 1 is not integrally divisible by an even integer greater than 2"

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5. (10) Consider the following three sets: A = {1,2,3}, B = {3,4,5}, and C = {1,3,5} Using a series of Venn diagrams and these three sets, pictorially verify the distributive law

$$A \cup (B \cap C) \equiv (A \cup B) \cap (A \cup C)$$

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6. (10) Proof the following:

"If two sets A and B, where $A \cap B = \varnothing$, are countable, then so is $C = A \cup B$ "

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7. **(10)** Two equivalence relations R and S are given by their relation matrices M_R and M_S. Show that R o S is not an equivalence relation.

$$M_R = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \qquad M_S = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

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8. (10) List all possible functions from X = {a, b, c} to Y = {0, 1, 2} and indicate in each case whether the function is one-to-one, onto, or one-to-one onto.

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9.(10) Consider the following series

$$\frac{1}{2!}+\frac{2}{3!}+\frac{3}{4!}+\ldots+\frac{n}{(n+1)!}$$

Whose value is 1/2, 5/6, 23/24 for n = 1, 2, 3 respectively. Guess the general law (by observing more values if necessary) and prove your guess using mathematical induction.

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10. (10) Using SQL express the following relational operators of relational algebra:

a) Product P x Q (Also called the Cartesian Product) is:

b) Difference P - Q is: