COT3100 Final Exam 2021

1.)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| T | T | T | T | T | T |
| T | T | F | T | T | T |
| T | F | T | T | F | T |
| T | F | F | F | F | F |
| F | T | T | T | F | T |
| F | T | F | T | F | T |
| F | F | T | T | F | T |
| F | F | F | F | F | F |

2.)

Commutativity

Negation

Domination

Identity

2x Associativity

Commutativity

Idempotence

Distributivity

3x Commutativity

Negation (because will always contain F)

**Identity**

3.)

Case 1: Consider an element x

Definition of Union and Relative Complacent

Case 1.1

Def. Union, S = any set

Relative Complacent and add parenthesis

Case 1.2

Def. Union, S = any set

Relative Complacent, Reorder, Add parenthesis

Case 1.3

Def. Union, S = any set

Relative Complacent, Reorder, Add parenthesis

**By Universal Generalization**

Case 2 Consider an element x

Definition of Union and Relative Complacent

Case 2.1

Relative Complacent

Def. Union, S = any set

Case 2.2

Def. Union, S = any set ,Relative Complacent

Def. Union, S = any set

Reorder, Add parenthesis

Case 2.3

Def. Union, S = any set ,Relative Complacent

Def. Union, S = any set

Reorder, Add parenthesis

**By Universal Generalization**

4.)

Case 1: Consider an element x

Definition of Union and Relative Complacent

Case 1.1

Relative Complacent

Def. of Union, , S= any set

Case 1.2

Relative Complacent

Def of Union, , any set S

Case 1.3

Relative Complacent

Def. of Union, , any set S

**Universal Generalization**

5.) Disprove

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A | B | C | D |  |  |  |
| Y | Y | Y | Y | Y | N | **N** |
| Y | Y | Y | N | Y | Y | Y |
| Y | Y | N | Y | Y | N | **N** |
| Y | Y | N | N | Y | Y | Y |
| Y | N | Y | Y | Y | N | **N** |
| Y | N | Y | N | Y | Y | Y |
| Y | N | N | Y | Y | N | **N** |
| Y | N | N | N | Y | Y | Y |
| N | Y | Y | Y | N | N | Y |
| N | Y | Y | N | Y | Y | Y |
| N | Y | N | Y | N | N | Y |
| N | Y | N | N | Y | Y | Y |
| N | N | Y | Y | N | N | Y |
| N | N | Y | N | Y | Y | Y |
| N | N | N | Y | N | N | Y |
| N | N | N | N | N | N | Y |

6.)

Induction on n

Base case

Induction Hypothesis:

Induction:

Arithmetic

Summation

I.H and Arithmetic

Arithmetic

Arithmetic

**Induction Principle**

7.)

Induction on n

Base case

Arithmetic

Induction Hypothesis:

Induction Step:

Arithmetic

Exponents

Induction Hypothesis

Powers

Distribution

is divisible by 41 Distribution

**By Induction**

8.) Accepting the following premises, conclude :

1. 2.

3. 4.

Premise 2, De Morgan’s

Conjunctive Simplification

Premise 1 and Conjunctive Simplification

Modus Tollens

Premise 4, De Morgan’s

Premise 3

De Morgan’s,

**Modus Tollens**

9.) HUDSONICUS

combinations that begin with a vowel or end with a consonant

duplicate combinations due to the inclusion-exclusion principle

**total actual ways to rearrange the word HUDSONICUS**

10.)

capturing at least five paperback

capturing at most 1 loose-leaf

capturing at most 3 spiral types

Therefore **unique combinations**

11.)

**chance of exactly 7 being St. Augustine-subtypes**

12.)

**chance of at least one being a Zoysia subtype**

13.)

chance of either St. Augustine-subtype or Zoysia-subtype, chance of neither.

**chance there are no St. Augustine or Zoysia-subtypes captured**

14.) with

**Not Reflexive** because x will result in a negative version of itself, for example will result in .

**Irreflexive** because x will never be the same as y, whatever x is y will be the negative version of that number.

**Symmetric** because y will always be the opposite of x so the equation will contain both for each value that is within the subset. For example and exist.

**Not Anti-Symmetric** because it is symmetric

**Not Transitive** since and but . For example,

**Complete** since or , all distinct pairs will relate at least one way or the other.

**Not an Ordering Relation** as it is not anti-symmetric or transitive

**Not an Equivalence Relation** because it is not reflexive and transitive, only symmetric

15.) with

**Reflexive** because will always be the same as y, for example

**Not Irreflexive** because it is reflexive

**Symmetric** because x will always be the same as y, for example ect.

**Anti-Symmetric** because it is composed only of self-related entries and don’t break the anti-symmetric property because the elements aren’t distinct

**Transitive** because . For example, .

**Complete** since it contains and , all pairs relate to each other one way or the other

**Not an Ordering Relation** as it isn’t irreflexive

**Is an Equivalence relation** because it is reflexive, symmetric and transitive.

16.) and let return the sum of the digits of x.

**Not Injective** because if and if as well and therefore breaks the rule of

**Surjective** because for every there will be a natural positive

**Not Bijective** because it is not Injective