**HW Assignments – CISC 2210 Discrete Math Fall 2018**

**Chapter 2 Logic**

Exercises 2.5, 2.6: as many as you need

Exercises 2.7: 1-5, 7, 9, 10

(\*note: Read 9 and 10)

Exercises 2.8: 1, 3

**Sets**

Exercises 2.1, 2.2, 2.3: as many as you need

Exercises 2.4: 1, 2, 4-8, 11a&b, 14a

**Quantifiers and Negation** Let the domain be Ζ, the integers.

|  |  |
| --- | --- |
| 1. Let Q(x,y) be x = y + 3. What are the truth values of    1. Q(1,2)    2. Q (3,0)    3. ∀x ∃y Q(x,y)    4. ∃y ∀x Q(x,y)    5. ∃x ∀y Q(x,y) 2. Let P(x) be x = x+1. What are the truth values of    1. ∀x P(x)    2. ∃x P(x) 3. Let P(x) be x2 > x.   Prove ~∀x P(x) | 1. Let R(x,y) be x + y = x – y. What are truth values of:    1. R(1,1)    2. R(2,0)    3. ∃x∃y R(x,y)    4. ∃y∀x R(x,y)    5. ∀x∃y R(x,y) 2. Let P(x) be x >= 0. Let Q(x) be x – 1 >= 0.   a) Prove that ~∀x (P(x) 🡪 Q(x))  b) Give an equivalent expression without using 🡪 |

**Chapter 3**

**Induction**

Exercises 3.1: 1b&c, 2a, 3-6, 8, ~~10~~, 12

Exercise 3.4: # 10

**Chapter 5**

Exercises 5.1: 1-3, read 5, 7, 8

Sample relations questions - p32 in packet

Exercises 5.2

Exercises 5.3: 3-10, skip 4

Exercises 5.5: 1-3, 5-11, 15b

(\*note:

1) book answers with error #2, #11a,b

2) 15b has no answer in the book or packet)

**Chapter 6**

Exercises 6.1:  4d,e, 5a, c, 8-12, 13b, c, 14b, 15, 16.

(note: If you are able to do 16 well, then everything else is good. )

Exercises 6.2:  1-7, 10, 11, example 6.20b (p309)

(note: For #7 – know and note the results)

**Chapter 7 Boolean Algabra**

Exercises 7.1: 1-5, 6a, c, 8

(notes:

1) For #5, prove **algebraically** using axioms like done in class. Answers are given handwritten on page 17 of the packet.

2) For #5b, hint: work from right to left)

Exercises 7.2:  1-3, read 4&5

**Chapter 8 Graphs**

Exercises 8.1:  1-8, read 9

Exercises 8.2:  1-5, 6. Look at example 8.5

HW question from class (non-isomorphic spanning subtrees)—see below

Exercises 8.3: 1-3, 4a, b, 5, 9a, c, 12a, b,c, 13

Exercises 8.4: 1a-c(as much of b as you need for c), 4a-d

Exercises 8.6:  1-6, 8 a-d, example 8.21 (p. 442)

Find all the **spanning subtrees** for this graph. Which are isomorphic?

There should be 5 equivalence classes (5 groups of isomorphic subtrees)

**Chapter 3 (continued)**

Exercises 3.2:  1-7, 9, 12-15

Exercises 3.3: 1, 3-6, 11-15

Exercises 3.4: 1, 3, 11, 14, 18

(Note: #3 will be on exam,

#11 do algebraically, not by induction

#14 read the paragraph before 14, then do 14)

Exercises 3.5: 16-18

**Chapter 4 Probability**

Exercises 4.1:  Example 4.6, Example 4.7 (p180-181), 1, 2, 4-6, additional \*6g (3 faces or 3 hearts),

Challenges: #7, #8, #10

(Note: For 6c, the answer is 1 - 0.7826)

Exercise 4.2: Read example 4.9 (p187), 1-9, skip 3.

(Note:

1) 6 & 7 are prof’s favorites

2) For 4a, the answer is 0.413

3) Add on to #1: P (A) = 0.7, P (B) = 0.8. A&B are independent. What is P (A U B)?

4) Add on to #7: 7d\* - are the events of knows FORTRAN and knows PASCAL independent?

5) Problem 9 is intense – read it

6) Problem 10 may be done in class)

Exercise 4.3: 1, 3, ~~4 -6, 9~~ Example 4.16, ~~4.17~~ (4 is crossed out)

**Bayes’ Theorem** The winner of a TicTacToe match is the first player to win 2 games. For each game, A has a 2/3 chance of winning over B. We don’t allow ties!. Find: (Ans: 20/27, 4/5)

a) Find the probability that A wins the match.

b) Find the probability that A won the first game, given that he won the match.

**Posets, Ordering, Lattices**

Exercise 7.1: 8, 9 (answers on p16 of packet)

Exercise 5.1: 7, 8

**Pigeonhole Principle**

1. The English alphabet has 21 consonants & 5 vowels. Prove the following:
   1. In any listing of the 26 letters, there must be at least 4 consecutive consonants.
   2. Give a list to show that you don’t have to have 5 consecutive consonants in a row.
   3. Suppose the list is made into a circle. What happens to a and b?
2. A box contains 8 green and 6 red balls. While being blindfolded, how many do you have to take out to be sure you have 2 of the same color?
3. In a city with n> 2 roads, prove that there must be at least 2 roads that have the same number of crossings.

**Recurrences** Give closed form of following:

1. f(0) = 1 f(n)=3 f˙(n − 1), n > 0
2. f(1) = x f(n)= x + f(n − 1), n > 1
3. f(0)=1 f(1)=2 f(n +1) = f(n − 1) + 2, n>0

**Infinite Sets**

1. Is there a correspondence between the States of the USA and the Senators? Explain.

2. Consider the set of cubed numbers: *C = {0, 1, 8, 27, 64, 125, …}.* Prove that it is countable.

3. a. Make a two-dimensional listing of all *positive* fractions. (Use the figure for the correspondence between N and NXN to guide you.) Prove that the set of all *positive* fractions is countable.

b. Why can’t you use a diagonalization argument on this set?

4. Prove that the set of functions from the positive integers= {1,2,3, …} into the binary digits={0,1} is uncountable.

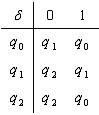
5. Give an example of two finite sets that are not equinumerous, i.e. that don’t have the same cardinality.

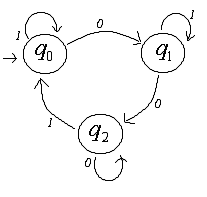
6. Consider the set (-10,10). This is all real numbers from -10 to +10. Is this set countable or uncountable?

**Finite Automata** *Indicate whether each statement is true or false.*

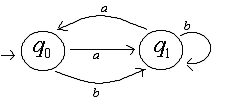
\_\_\_\_ 1. Given the state transition table for a state transition function *f* of a FA *M ,* where the initial state is  , the state of *M* after processing the string  is  .



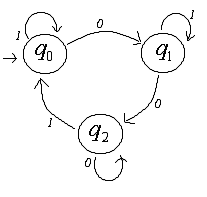
\_\_\_\_ 2. In the following state table, the initial state is . This state table corresponds to the state diagram shown below. 



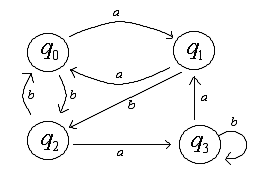
\_\_\_\_ 3. Given the state diagram below where the initial state is  , the state after processing the string  is  .



\_\_\_\_ 4. Given the state diagram below where  is the initial state, the state after processing the string  is  .



\_\_\_\_ 5. Given the state diagram with initial state  , the state after processing the string  is .



Know how to draw the automata and trace the states. Also know if a string is accepted or not when the accepting states are indicated. (Answers below.)

1. ANS: F

2. ANS: T

3. ANS: T

4. ANS: F

5. ANS: T