Class: Discrete Mathematics

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**HW1**

8.

f) If I didn’t buy a lottery ticket this week, I wouldn’t win the million dollar jackpot.

g) I didn’t buy a lottery ticket this week, and I didn’t win the million dollar jackpot.

h) either I didn’t buy a lottery ticket this week, or I bought a lottery ticket this week and won the million dollar jackpot.

14.

a) r ∧ ¬q

b) p ∧ q ∧ r

c) p → r

d) (p ∧ ¬q) → r

e) (p ∧ q) → r

f) (p ∨ q) → r

24.

a) If you do not send me an e-mail message, then I will not remember to send you the address.

b) If you were born in the United States, then you will be a citizen of this country.

c) If you keep your textbook, then it will be a useful reference in your future courses.

d) If the Red Wings’ goalie plays well, then they will win the Stanley Cup.

e) If you had the best credentials, then you would get the job.

f) If there is a storm, then the beach erodes.

g) If you have a valid password, then you will log on to the server.

34.

|  |  |  |
| --- | --- | --- |
| p | q | p⊕¬q |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

c)

44.

d) (11011 ∨ 01010) ∧ (10001 ∨ 11011) = 11011

**HW2**

P35

10. a)

|  |  |  |  |
| --- | --- | --- | --- |
| p | q | [¬p∧(p∨q)] | [¬p∧(p∨q)] →q |
| 0 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 |

d)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | r | p∨q | p→r | q→r | [(p∨q)∧(p→r)∧(q→r)] →r |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

12.

a) [¬p∧(p∨q)] → q ≡ (¬p∧q) →q ≡¬[(¬p∨q)∧¬q] ≡ (p∨¬q)∨q ≡ (p∨q)∨1 ≡ 1

b) [(p→q)∧(q→r)] → (p→r) ≡¬ [(¬p∨q)∧(¬q∨r) ]∨(¬p∨r)

≡[(¬p∨q)∧(¬q∨r) ]∧(p∧¬r)

≡{[(¬p∨q)∧¬q]∨[(¬p∨q)∧r]}∧(p∧¬r)

≡[(¬p∧¬q)∨(¬p∧r)∨(q∧r)]∧(p∧¬r)

≡1

c) [p∧(p→q)]→q ≡ ¬ [p∧(¬p∨q)]∨q ≡¬{[p∧(¬p∨q)]∧¬q} ≡ ¬ {[0∨(p∧q)]∧¬q} ≡ 1

d) [(p∨q)∧(p→r)∧(q→r)] →r ≡ ¬[(p∨q)∧(¬p∨r)∧(¬q∨r)]∨r

≡ [(¬p∧¬q)∨(p∧¬r)∨(q∧¬r)]∨r

≡1.

P78

5.

a) Sarah Smith has visited www.att.com.

b) Someone has visited www.imdb.org.

c) There are websites José Orez has visited.

d) There is a website both Ashok Puri and Cindy Yoon have visited.

e) Someone has visited all the websites David Belcher has visited.

f) There are students X and Y, such that they have visited all the websites each other has.

6.

a) Randy Goldberg is a student in class CS 252.

b) There is at least a student in class Math 695.

c) Carol Sitea is enrolled in a class.

d) There is a student in both classes Math 222 and CS 252.

e) There are students X and Y such that Y is in every class that X is in.

f) There are students X and Y such that Y is in every class that X is in, and vice versa.

Proof:

1.， ， 

(¬p∨q)∧(¬q∨r)∧(¬r∨s)

≡ [¬p∧(¬q∨r)∧(¬r∨s)]∨[q∧(¬q∨r)∧(¬r∨s)]

≡ [¬p∧¬q∧(¬r∨s)]∨[¬p∧r∧(¬r∨s)]∨[q∧¬q∧(¬r∨s)]∨[q∧r∧(¬r∨s)]

≡ [¬p∧¬q∧¬r]∨[¬p∧¬q∧s]∨[¬p∧r∧s]∨[q∧r∧s]

≡ ¬p∨s ≡ p→s.

2.， ，， 

(¬r∨¬q)∧(r∨s)∧(¬s∨¬q)∧(¬p∨q)

≡ (¬r∧s∧¬q∧¬p)∨(r∧¬s∧¬q∧¬p)∨(¬q∧s∧¬p)∨(¬q∧r∧¬p). ⟹ ¬p.

**HW3**

P53

9.

a) ∃x(P(x)∧Q(x))

b) ∃x(P(x)∧¬Q(x))

c) ∀x(P(x)∨Q(x))

d) ∀x(¬P(x)∧¬Q(x))

62.

a) ∀x(P(x)∧¬S(x))

b) ∀x(R(x)∧S(x))

c) ∀x(P(x)∧Q(x))

d) ∀x(Q(x)∧¬R(x))

e) Yes.

P64

9.

a) ∀x(L(x,Jerry))

c) ∃y∀x(L(x,y))

e) ∃x(¬L(Lydia,x))

g) ∃!y∀x(L(x,y))

i) ∀x(L(x,x))

28.

a) 1

b) 0

c) 1

d) 0

e) 1

f) 0

g) 1

h) 0

i) 0

j) 1

Proof:

1.  

For a given x, if x(¬A(x)) ⟹ x(B(x)) is not certain, but A(x) is false ⟹ A(x) → B(x);

Else A(x) ⟹ B(x) ⟹ A(x) → B(x).

Proven.

2. ，，

∀x[(A(x) ∨ B(x)) ∧ (¬B(x) ∨ ¬C(x)) ∧ (C(x))]

≡ ∀x(A(x) ∧ ¬B(x) ∧ C(x)) ⟹ ∀x(A(x)).