Alex Lundin

SE 3306

Assignment 01 due 01/26/16

CH 1.1

1

1. T
2. F
3. T
4. F
5. Not a proposition
6. Not a proposition

3

1. Mei does not have a MP3 player
2. There is pollution in New Jersey
3. 2 + 1 != 3 (not equal to)
4. The summer in Maine is not hot or not sunny (DeMorgan’s, negate and flip the and to or)

7

1. F, ACME had the highest annual revenue
2. T, p is true, the or statement disregards q
3. T, p is true and q is true, so implication is true
4. T, p is false so the implication is true
5. T, p is true and q is true so the implication is true

27

1. If it snows today, I will ski tomorrow

p→ q

Converse: q→ p If I ski tomorrow, it will snow today.

Contrapositive: ¬q→¬ p If I do not ski tomorrow, it will not snow today.

Inverse: ¬p→ ¬q If it doesn’t snow today, I will not ski tomorrow.

1. I come to class whenever there is going to be a quiz

If there is a quiz, then I come to class

p→ q

Converse: q→ p If I come to class then there will be a quiz.

Contrapositive: ¬q→¬ p If do not come to class then there is not a quiz.

Inverse: ¬p→ ¬q If there is not a quiz, then I don’t come to class.

1. A positive integer is a prime only if it has no divisors other than 1 and itself.

“if p, q” “p only if q” (page 6)

p→ q

Converse: q→ p A positive integer is a prime if it has no divisors other than 1 and itself

Contrapositive: ¬q→¬ p If positive integer has divisors other than 1 and itself, then it is not prime.

Inverse: ¬p→ ¬q If a positive integer is not a prime then it has a divisor other than 1 and itself.

38 Truth Table q→ p

p q r s p→ q ((p→ q)→r) (((p→ q)→r)→s)

F F F F T F T

F F F T T F T

F F T F T T F

F F T T T T T

F T F F T F T

F T F T T F T

F T T F T T F

F T T T T T T

T F F F F T F

T F F T F T T

T F T F F T F

T F T T F T T

T T F F T F T

T T F T T F T

T T T F T T F

T T T T T T T

CH 1.2

2 e = you’re old than 18 years old

p = you have permission from parent

m = you can see the movie

You can see the movie if and only if you are over 18 years old or you have permission from a parent

m 🡨🡪 (e ∨ p)

7

p = the message is scanned for viruses

q = the message was sent from an unknown system

m = you can see the movie

1. The message is scanned for viruses whenever the message was sent from an unknown system.

P whenever q

q→ p

1. The message was sent from an unknown system, but was not scanned for viruses

q ∧¬p

1. It is necessary to scan the message for viruses whenever it was sent from an unknown system.

q→ p

1. When a message is not sent from an unknown system, it is not scanned for viruses.

¬q→ ¬p

17

The waitress asks the first professor is everyone wants coffee. Then the first professor says he does not know if everyone wants coffee, his answer implies that he does in fact want coffee. His answer also implies the obvious fact that he does not know if everyone wants coffee yet. The second professor answers the same way. Also implying the same he would like coffee. If he did not want coffee the answer would be “No, everyone does not want coffee”. But he is not sure yet if everyone will partake. When the third professor answers “No, everyone does not want coffee” his answer implies that the first two professors will enjoy a beverage but he will not.

CH 1.3

1

1. Truth Table p ∧ T = p

p T p ∧ T

F T F

T T T

From the truth table the p and p ∧ T column match.

1. Truth Table p ∨ F = p

p F p ∨ F

F F F

T F T

From the truth table the p and p ∨ F column match.

1. Truth Table p ∧ F = F

p F p ∧ F

F F F

T F F

Anything anded with F will always be false.

1. Truth Table p ∨ T = T

p T p ∨ F

F T T

T T T

Anything or’ed with T will always be true.

1. Truth Table p ∨ p = p

p p p ∨ p

F F F

T T T

Anything or’ed with itself will always be itself.

1. Truth Table p ∧ p = p

p p p ∧ p

F F F

T T T

Anything and’ed with itself will always be itself.

2

¬(¬p) = p

(p) = p double negation law

7

1. Jan is rich and happy

Jan is either, not rich or not happy

1. Carlos will bicycle or run tomorrow

Carlos will not bicycle and will not run tomorrow.

1. Mei walks or takes the bus to class

Mei walks and takes the bus to class

1. Ibrahim is smart and hard working

Ibrahim is not smart or Ibrahim is not hard working

17

Truth Table ¬(p 🡨🡪 q) = (p 🡨🡪 ¬q)

p q ¬p ¬q p 🡨🡪 q ¬(p 🡨🡪 q) (p 🡨🡪 ¬q)

F F T T T F F

T F F T F T T

F T T F F T T

T T F F T F F

From the truth table we can see the last two columns are equivalent.

CH 1.4

1

P(x) means “x =< 4”

1. P(0) = “0 =< 4” = T
2. P(4) = “4 =< 4” = T
3. P(6) = “6 =< 4” = f

9

P(x) means “x cans speak Russian”

Q(x) means “x knows computer language C++”

1. There is a student in your school that can speak Russian and knows C++

A student is existential

∃x (P(x) ∧ Q(x))

1. There is a student in your school that can speak Russian and doesn’t know C++

A student is existential

∃x (P(x) ∧ ¬Q(x))

1. Every student at your school either can speak Russian or knows C++

Every student is universal

∀x(P(x) ∨ Q(x))

1. No student at your school either can speak Russian or knows C++

No student is negated universal

¬∀x(P(x) ∨ Q(x))

25

P(x) means “x is perfect”

F(x) means “x is your friend”

1. No one is perfect

Everyone is not perfect

∀x (¬P(x))

1. Not everyone is perfect

Negation of everyone is perfect

¬∀x (P(x))

1. All your friends are perfect

∀x(F(x) → P(x))

1. At least one of your friends is perfect

∃x(F(x) ∧P(x))

1. Everyone is your friend and is perfect

∀x(F(x) ∧ P(x))

1. Not everyone is your friend or someone is not perfect

(¬∀x Q(x) ) ∨ ( ∃x¬P(x))

35

1. None
2. 0 is neither greater than 0 or less than 0, x = 0
3. Any x other than 1 does not equal 1, x = 2

CH 1.5

1

1. For all real numbers x, for some real number y, we can choose any x we like and there will always be a y to choose that is greater
2. For all real numbers x, for some real number y,

x is greater than or equal to 0 AND y is greater than or equal to 0 IMPLIES x times y is greater than or equal to 0

(non negative numbers multiplied together yield a non-negative result)

1. For all real numbers x, for all real numbers y, for some real number z,

x times y equals z

(real numbers closed under multiplication)

8

1. {2,3,4…} no {2} is not a member
2. {4,16,25,36…} no {2} is not a member
3. {2,{2}} yes {2} is a member
4. {{2},{{2}}} yes {2} is a member
5. {{2},{2{2}}} yes {2} is a member
6. {{{2}}} no {2} is not a member

8

M(x,y) “x has sent y a email message”

T(x,y) “x has telephoned y”

1. ¬M(Chou, Koko)
2. ¬(M(Arlene, Sarah) ∨ T(Arlene, Sarah))

33

1. ¬∀x∀y P(x,y)

∃x ∃y ¬P(x,y) bring negation inside quantifiers

1. ¬∀y∃x P(x,y)

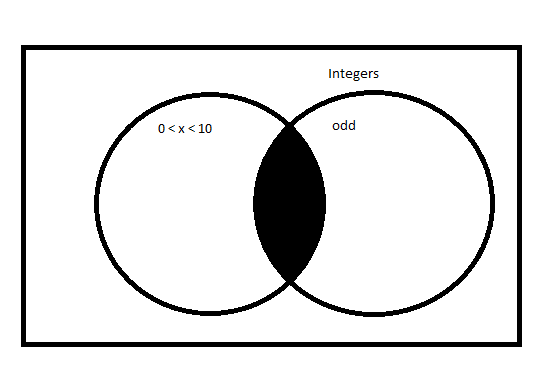
∃y∀x ¬P(x,y) bring negation inside quantifiers

CH 2.1

2

1. {x | y is a non negative integer such that y\*3 = x}
2. {x | x is a integer such that -3 <= x <= 3}
3. {x | x is a letter in the alphabet such that m <= x <= p}

12



19

1. 1
2. 1
3. 2
4. 3

21

1. { null set , {a}}
2. { null set , {a}, {b}, {a,b}}
3. { null set , { null set }, {{ null set }}, { null set , { null set }}}

33

A ^ 2 is A x A

So we match each n tuple from the first set with its corresponding element in the second set

1. {(0,0),(0,1),(0,3),(1,0),(1,1),(1,3),(3,0),(3,1),(3,3)}
2. {(1,1),(1,2),(1,a),(1,b),(2,1),(2,2),(2,a),(2,b),(a,1),(a,2),(a,a),(a,b),(b,1),(b,2),(b,a),(b,b)}