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SE 3306

Assignment 01 due 01/26/16

CH 1.1

1

a.) T
b.) F
c.) T
d.) F
e.) Not a proposition
f.) Not a proposition

3

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

7

a.) F, ACME had the highest annual revenue
b.) T, p is true, the or statement disregards q
c.) T, p is true and q is true, so implication is true
d.) T, p is false so the implication is true
e.) T, p is true and q is true so the implication is true

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a.) If it snows today, I will ski tomorrow
$p \rightarrow q$

Converse:	$q \rightarrow p$	If I ski tomorrow, it will snow today.
Contrapositive:	$\neg q \rightarrow \neg p$	If I do not ski tomorrow, it will not snow today.
Inverse:	$\neg p \rightarrow \neg q$	If it doesn't snow today, I will not ski tomorrow.

b.) I come to class whenever there is going to be a quiz
If there is a quiz, then I come to class
$p \rightarrow q$

Converse:	$q \rightarrow p$	If I come to class then there will be a quiz.
Contrapositive:	$\neg q \rightarrow \neg p$	If do not come to class then there is not a quiz.
Inverse:	$\neg p \rightarrow \neg q$	If there is not a quiz, then I don't come to class.

c.) 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)

$p \rightarrow q$

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

Contrapositive: $\neg q \rightarrow \neg p$ If positive integer has divisors other than 1 and itself, then it is not prime.

Inverse: $\neg p \rightarrow \neg q$ If a positive integer is not a prime then it has a divisor other than 1 and itself.

38 Truth Table $q \rightarrow p$

p	q	r	s	$p \rightarrow q$	$((p \rightarrow q) \rightarrow r)$	$(((p \rightarrow q) \rightarrow r) \rightarrow s)$
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 1.3

1

a) Truth Table $p \wedge T = p$

p	T	p ∧ T
F	T	F
T	T	T

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

b) Truth Table $p \vee F = p$

p	F	p ∨ F
F	F	F
T	F	T

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

c) Truth Table $p \wedge F = F$

p	F	p ∧ F
F	F	F
T	F	F

Anything anded with F will always be false.

d) Truth Table $p \vee T = T$

p	T	p ∨ F
F	T	T
T	T	T

Anything or'ed with T will always be true.

e) Truth Table $p \vee p = p$

p	p	p ∨ p

F	F	F
T	T	T

Anything or'ed with itself will always be itself.

f) Truth Table $p \wedge p = p$

p	p	$p \wedge p$
F	F	F
T	T	T

Anything and'ed with itself will always be itself.

2

$\neg(\neg p) = p$

$(p) = p$ double negation law

7

a.) Jan is rich and happy
Jan is either, not rich or not happy

b.) Carlos will bicycle or run tomorrow
Carlos will not bicycle and will not run tomorrow.

c.) Mei walks or takes the bus to class
Mei walks and takes the bus to class

d.) Ibrahim is smart and hard working
Ibrahim is not smart or Ibrahim is not hard working

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Truth Table $\neg(p \leftrightarrow q) = (p \leftrightarrow \neg q)$

p	q	$\neg p$	$\neg q$	$p \leftrightarrow q$	$\neg(p \leftrightarrow q)$	$(p \leftrightarrow \neg q)$
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”

a.) P(0) = “0 =< 4” = T
b.) P(4) = “4 =< 4” = T
c.) P(6) = “6 =< 4” = f

9

P(x) means “x cans speak Russian”

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

a.) There is a student in your school that can speak Russian and knows C++
A student is existential
$\exists x\,(P(x) \wedge Q(x))$
b.) There is a student in your school that can speak Russian and doesn’t know C++
A student is existential
$\exists x\,(P(x) \wedge \neg Q(x))$

c.) Every student at your school either can speak Russian or knows C++
Every student is universal
$\forall x(P(x) \vee Q(x))$
d.) No student at your school either can speak Russian or knows C++

No student is negated universal

$\neg\forall x(P(x) \vee Q(x))$

25

P(x) means “x is perfect”

F(x) means “x is your friend”

a.) No one is perfect
Everyone is not perfect
$\forall x\,(\neg P(x))$
b.) Not everyone is perfect
Negation of everyone is perfect
$\neg\forall x\,(P(x))$

c.) All your friends are perfect

$\forall x(F(x) \rightarrow P(x))$

d.) At least one of your friends is perfect
$\exists x(F(x) \wedge P(x))$

e.) Everyone is your friend and is perfect
$\forall x(F(x) \wedge P(x))$

f.) Not everyone is your friend or someone is not perfect
$(\neg \forall x\, Q(x)) \vee (\exists x \neg P(x))$

35

a.) None
b.) 0 is neither greater than 0 or less than 0, x = 0
c.) Any x other than 1 does not equal 1, x = 2

CH 1.5

1

a.) 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
b.) 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)
c.) 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

a.) {2,3,4…} no {2} is not a member
b.) {4,16,25,36…} no {2} is not a member
c.) {2,{2}} yes {2} is a member
d.) {{2},{{2}}} yes {2} is a member
e.) {{2},{2{2}}} yes {2} is a member
f.) {{{2}}} no {2} is not a member

13

M(x,y) “x has sent y a email message”

¬M(x,y) “x has no sent y a email message”

T(x,y) “x has telephoned y”

¬T(x,y) “x has not telephoned y”

a.) $\neg M(\text{Chou, Koko})$

b.) $\neg(M(\text{Arlene, Sarah}) \vee T(\text{Arlene, Sarah}))$

33

a.) $\neg\forall x\forall y\ P(x,y)$

$\exists x\ \exists y\ \neg P(x,y)$ bring negation inside quantifiers

b.) $\neg\forall y\exists x\ P(x,y)$

$\exists y\forall x\ \neg P(x,y)$ bring negation inside quantifiers

CH 2.1

2

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

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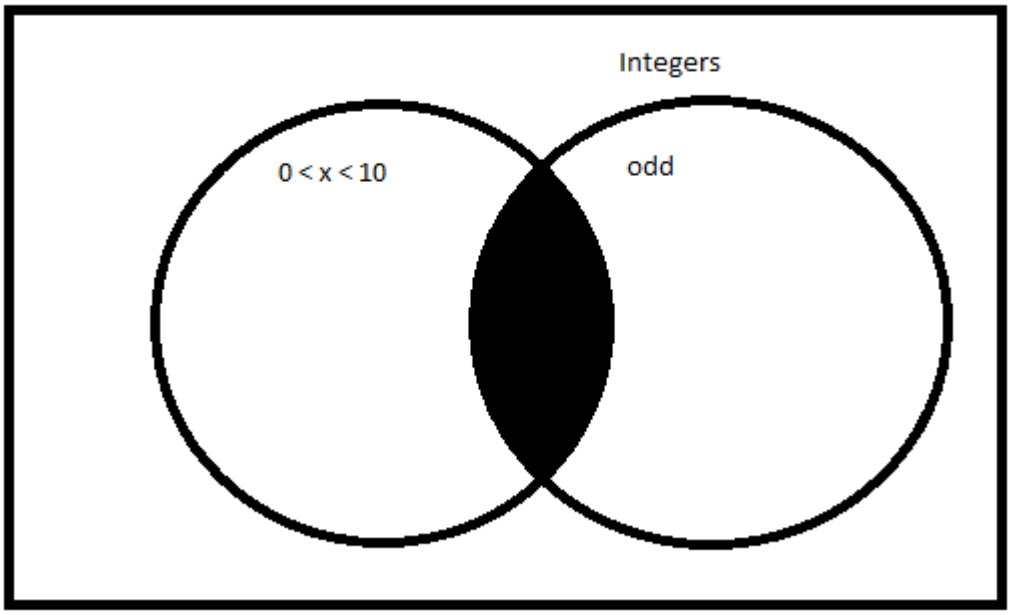

19

a.) 1
b.) 1
c.) 2
d.) 3

21

a.) { null set , {a}}
b.) { null set , {a}, {b}, {a,b}}
c.) { 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

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