MAT 133 : Discrete Mathematics

Assignment no. 01

Submission date :

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Exercises of Chapter 1.1 Propositional Logic

1. a. proposition, true

b. proposition, false

c. proposition, true

d. proposition, false

e. not proposition,

f. not proposition,

2. a. not proposition

b. not proposition

c. proposition, truth

d. not proposition

e. proposition, false

f. not proposition

3. a. Linda is not younger than Sanjay.

b. Mei does not make more money than Isabella.

c. Moshe is not taller than Monica.

d. Abby is not richer than Ricardo.

4. a. Janice has more Facebook friends than Juan.

b. Quincy is smarter than Venkat.

c. Zelda does not drive mere miles to school than Paola.

d. Briana does not sleep longer than Gloria.

5. a. Mei does not have an MP3 player.

b. There is pollution in New Jersey.

c. 2+1≠3

d. The summer in Maine is not hot and sunny.

6. a. Jennifer and Teja are not both friends.

b. There is not 13 items in a baker’s dozen.

c. Abby did not send more than 100 text massages

yesterday.

d. 121 is not a perfect square.

7. a. Steve has 100 GB or less free disk space on his

laptop.

b. Zack does not block e-mails and texts from Jennifer.

c. 7 x 11 x 13 ≠ 999

d. Diane did not ride her bicycle 100 miles on Sunday.

8. a. True

b. True

c. False

d. False

e. False

9. a. False

b. True

c. True

d. True

e. True

10. a. I did not buy a lottery ticket this week.

b. I bought a lottery ticket this week or I won the

million dollar jackpot.

c. If I bought a lottery ticket this week, then I won the

million dollar jackpot.

d. If I bought a lottery ticket this week and I won the

million dollar jackpot.

e. I bought a lottery ticket this week if and only if I won

the million dollar jackpot.

f. If I did not buy a lottery ticket this week, than i did

not win the million dollar jackpot.

g. I did not buy a lottery ticket this week and i did not

win the million dollar jackpot.

h. Either I did not buy a lottery ticket this week, or I

bought a ticket and won the million dollar jackpot.

11. a. Sharks have not been spotted near the shore.

b. Swimming at the New Jersey shore is allowed and

sharks have been spotted near the shore.

c. Swimming at the New Jersey shore is not allowed, or

sharks have been spotted near the shore.

d. If swimming at the New Jersey shore is allowed, then

sharks have not been spotted near the shore.

e. If sharks have not been spotted near the shore, then swimming

at the New Jersey shore is allowed.

f. If swimming at the New Jersey shore is not allowed,

then sharks have not been spotted near the shore.

g. Swimming at the New Jersey shore is allowed if and

only if sharks have not been spotted near the shore.

h. Swimming at the New Jersey shore is not allowed,

and either swimming is allowed or sharks have not been

spotted near the shore.

12. a. The election is not decided.

b. The election is decided or the votes have been

counted.

c. The election is not decided and the votes have been

counted.

d. If the votes have been counted, then the election is

decided.

e. If the votes have not been counted, then the election

is not decided.

f. If the election is not decided, then the votes have not

been counted.

g. The election is decided if and only if the votes have

been counted.

h. Either the votes have not been counted, or the

election is not decided and the votes have been counted.

13. a. p ∧ q

b. p ∧ ¬q

c. ¬p ∧ ¬q

d. q ∨ p

e. p → q

f. (p ∨ q) ∧ (p → ¬q)

g. p ↔ q

14. a. If you have the flu, then you miss the final

examination.

b. You do not miss the final examination if and only if you pass the course

c. If you miss the final examination, then you do not

pass the course.

d. You have the flu, or you miss the final examination,

or you pass the course.

e. If you have the flu, then you do not pass the course,

or if you miss the final examination, then you do not

pass the course.

f. Either you have the flu and miss the final

examination, or you do not miss the final examination

and pass the course.

15. a. ¬p

b. p ∧ ¬q

c. p → q

d. ¬p → ¬q

e. p → q

f. q ∧ ¬p

g. q → p

16. a. r ∧ ¬q

b. p ∧ q ∧ r

c. r → p

d. p ∧ ¬q ∧ r

e. (p ∧ q) → r

f. r ↔ (q ∨ p)

17. a. r ∧ ¬p

b. (¬p ∧ q) ∧ r

c. r → (q ↔ ¬p)

d. ¬q ∧ (¬p ∧ r)e.

e. q → (¬r ∧ ¬p)

f. (p ∧ r) → ¬q

18. a. True.

b. False.

c. True.

d. False.

19. a. False

b. True

c. True

d. True

20.a. True

b. True

c. False

d. True

21.a. Exclusive OR {Usually one drink, not both, is

served}

b. Inclusive OR {Password can satisfy either or both

conditions}

c. Inclusive OR {Either course qualifies as a

prerequisite}

d. Inclusive OR {Payment can be made with either or

both currencies}

22.a. Inclusive OR. {Having either language is fine, but

knowing both doesn't disqualify you.}

b. Exclusive OR. {You’re typically offered a choice—

soup or salad—not both.}

c. Inclusive OR. {Having both is acceptable, but only

one is required.}

d. Exclusive OR. {It’s a strict either-or: either you

publish, or you face consequences.}

23.

|  |  |  |
| --- | --- | --- |
| Inclusive Meaning | Exclusive Meaning | Intended |
| a) Either or  both  accepted | Only one  course  qualifies | Inclusive OR |
| b) Possibly  both perks | Only one of  two options | Exclusive OR |
| c) Both sets  included | Only one  menu set | Exclusive OR |
| d) One or both conditions close school | Only one  condition  needed | Inclusive OR |

24. a. If you get promoted, then you washed the boss’s car.

b. If winds are from the south, then there is a spring

thaw.

c. If you bought the computer less than a year ago, then

the warranty is good.

d. If Willy cheats, then he gets caught.

e. If you can access the website, then you paid a

subscription fee.

f. If you know the right people, then you get elected.

g. If Carol is on a boat, then she gets seasick.

25. a. If the wind blows from the northeast, then it snows.

b. If it stays warm for a week, then the apple trees will

bloom.

c. If the Pistons win the championship, then they beat

the Lakers.

d. If you are at the top of Long’s Peak, then you walked

eight miles.

e. If you are world famous, then you will get tenure as a

professor.

f. If you drive more than 400 miles, then you will need

to buy gasoline.

g. If your guarantee is good, then you bought your CD player less than 90 days ago.

h. If the water is not too cold, then Jan will go

swimming.

i. If people believe in science, then we will have a

future.

26. a. If I remember to send you the address, then you sent

me an e-mail message.

b. If you were born in the United States, then you are a

citizen of this country.

c. If you keep your textbook, then it will be a useful

reference in your future courses.

d. If their goalie plays well, then the Red Wings will

win the Stanley Cup.

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

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

g. If you can log on to the server, then you have a valid

password.

h. If you do not begin your climb too late, then you will

reach the summit.

i. If you are among the first 100 customers tomorrow,

then you will get a free ice cream cone.

27. a. You buy an ice cream cone if and only if it is hot

outside.

b. You win the contest if and only if you have the only

winning ticket.

c. You get promoted if and only if you have

connections.

d. Your mind will decay if and only if you watch

television.

e. The trains run late if and only if I take them.

28. a. You will get an A in this course if and only if you

learn how to solve discrete mathematics problems.

b. You are informed if and only if you read the

newspaper every day.

c. It rains if and only if it is a weekend day.

d. You can see the wizard if and only if the wizard is not

in.

e. My airplane flight is late if and only if I have to catch

a connecting flight.

29. a. i. Converse: If I ski tomorrow, then it snowed today.

ii. Inverse: If it does not snow today, then I will not

ski tomorrow.

iii. Contrapositive: If I do not ski tomorrow, then it

did not snow today.

b. i. Converse: If I come to class, then there is going to

be a quiz.

ii. Inverse: If there is not going to be a quiz, then I do

not come to class.

iii. Contrapositive: If I do not come to class, then

there is not going to be a quiz.

c. i. Converse: If a number has no divisors other than 1

and itself, then it is a prime.

ii. Inverse: If a positive integer is not prime, then it

has divisors other than 1 and itself.

iii. Contrapositive: If a number has divisors other

than 1 and itself, then it is not prime.

30. a. i. Converse: If I stay at home, then it snowed tonight

ii. Inverse: If it does not snow tonight, then I will not

stay at home

iii. Contrapositive: If I do not stay at home, then it did

not snow tonight

b. i. Converse: If I go to the beach, then it is a sunny

summer day

ii. Inverse: If it is not a sunny summer day, then I do

not go to the beach

iii. Contrapositive: If I do not go to the beach, then it

is not a sunny summer day

c. i. Converse: If I sleep until noon, then I stayed up

late

ii. Inverse: If I do not stay up late, then I will not

sleep until noon

iii. Contrapositive: If I do not sleep until noon, then I

did not stay up late

31. a. 21 = 2 32. a. 22 = 4

b. 24 = 16 b. 23 = 8

c. 26 = 64 c. 26 = 64

d. 24 = 16 d. 25= 32

33. a)

|  |  |  |
| --- | --- | --- |
| P | **￢P** | P **∧ ￢P** |
| T | F | F |
| F | T | F |

b)

|  |  |  |
| --- | --- | --- |
| P | **￢P** | P **∨ ￢P** |
| T | F | T |
| F | T | T |

c)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | **￢*q*** | ***p*∨￢*q*** | **( *p*∨￢*q*) → *q*** |
| T | T | F | T | T |
| T | F | T | T | F |
| F | F | T | T | F |
| F | F | T | T | F |

d)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | ***p* ∨ *q*** | ***p* ∧ *q*** | **( *p* ∨ *q*) → ( *p* ∧ *q*)** |
| T | T | T | T | T |
| T | F | T | F | F |
| F | T | T | F | F |
| F | F | F | F | F |

e)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | ***p* → *q*** | **￢*q*** | **￢*p*** | **￢*q* → ￢*p*** | ***(p* → *q*) ↔(￢*q* → ￢*p*)** |
| T | T | T | F | F | T | T |
| T | F | F | T | F | F | T |
| F | T | T | F | T | T | T |
| F | F | T | T | T | T | T |

f)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| p | q | ***p* → *q*** | ***q* → *p*** | **( *p* → *q*) →(*q* → *p*)** |
| T | T | T | T | T |
| T | F | F | T | T |
| F | T | T | F | F |
| F | F | T | T | T |

35.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | **( *p* ∨ *q*) → ( *p ⊕ q*)** | **( *p ⊕ q*) → ( *p* ∧ *q*)** | **( *p* ∨ *q*) *⊕* ( *p* ∧ *q*)** | **( *p* ↔ *q*) *⊕* (￢*p* ↔ *q*)** | **( *p ⊕ q*) → ( *p ⊕* ￢*q*)** |
| T | T | F | T | F | T | T |
| T | F | T | F | T | T | F |
| F | T | T | F | T | T | F |
| F | F | T | T | F | T | T |

41.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | r | S | ***p* ↔ *q*** | ***r* ↔ *s*** | **(*p* ↔ *q*) ↔(*r* ↔ *s*)** |
| T | T | T | T | T | T | T |
| T | T | T | F | T | F | F |
| T | T | F | T | T | F | F |
| T | T | F | F | T | T | T |
| T | F | T | T | F | T | F |
| T | F | T | F | F | F | T |
| T | F | F | T | F | F | T |
| T | F | F | F | F | T | F |
| F | T | T | T | F | T | F |
| F | T | T | F | F | F | T |
| F | T | F | T | F | F | T |
| F | T | F | F | F | T | F |
| F | F | T | T | T | T | T |
| F | F | T | F | T | F | F |
| F | F | F | T | T | F | F |
| F | F | F | F | T | T | T |

43. The first statement is true if and only if at least one of p, q, r is true.

The second clause is true if and only if at least one of the three variables is false.

So, the entire statement is true if and only if at least one of the three variables is false.