

TMA4140: Homework Set 1

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Contents

1	1.1	2
	1.1 12c	2
	1.2 12f	2
	1.3 14	2
	1.3.1 14.a	2
	1.3.2 14.e	2
2	1.3	2
	2.1 10	2
	2.1.1 10.a	2
	2.1.2 10.b	3
	2.1.3 10.c	3
	2.1.4 10.d	3
3	1.4	3
	3.1 24d	3
	3.2 24e	4
4	1.5	4
	4.1 12b	4
	4.2 12e	4
	4.3 30c	4
	4.4 30e	4

1 1.1

1.1 12c

You miss the final examination therefore you do not pass the course.

1.2 12f

You have the flu and you miss the final examination or you don't have the flu and you pass the course.

1.3 14

p: You get an A on the final.

q: You do every exercise in this book.

r: you get an A in this class.

1.3.1 14.a

$$r \wedge \neg q$$

1.3.2 14.e

$$(p \wedge q) \rightarrow r$$

2 1.3

2.1 10

2.1.1 10.a

p	q	$\neg p$	$p \wedge q$	$(\neg p \wedge (p \vee q))$	$(\neg p \wedge (p \vee q)) \rightarrow q$
0	0	1	0	0	1
0	1	1	0	0	1
1	0	0	0	0	1
1	1	0	1	0	1

Proven: It's a Tautology!

2.1.2 10.b

p	q	r	$p \rightarrow q$	$q \rightarrow r$	$p \rightarrow q \wedge q \rightarrow r$	$p \rightarrow r$	$(p \rightarrow q \wedge q \rightarrow r) \rightarrow (p \rightarrow r)$
0	0	0	1	1	1	1	1
1	0	0	0	1	0	0	1
0	1	0	1	0	0	1	1
1	1	0	1	0	0	0	1
0	0	1	1	1	1	1	1
1	0	1	0	1	0	1	1
0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1

Proven: It's a Tautology!

2.1.3 10.c

$[p \wedge (p \rightarrow q)] \rightarrow q$

p	q	$p \rightarrow q$	$p \wedge (p \rightarrow q)$	$[p \wedge (p \rightarrow q)] \rightarrow q$
0	0	1	0	1
0	1	1	0	1
1	0	0	0	1
1	1	1	1	1

Proven: It's a Tautology!

2.1.4 10.d

Proven: It's a Tautology! See table 1 on page 5.

3 1.4

3.1 24d

All students in your class can solve quadratic equations.

1. Domain: People in my class.

$\forall x Q(x)$

2. Domain: All People

$P(x)$: x in my class $Q(x)$: x can solve quadratic equations
 $\forall x(P(x) \rightarrow Q(x))$

3.2 24e

$R(x)$: x want to be rich.

1. Domain: People in my class.

$\exists x \neg R(x)$

2. Domain: All People

$\exists x(P(x) \wedge \neg R(x))$

4 1.5

4.1 12b

Rachel has not chatted with Chelsea.

Can be expressed as $\neg C(Rachel, Chelsea)$

Where $C(x,y)$ is the relation, x have chatted with y .

4.2 12e

$\forall y C(Sanjay, y) \wedge \neg C(Sanjay, Joseph)$

4.3 30c

$\neg \exists y(Q(y)) \wedge \neg \exists y(\forall x \neg R(x, y))$

$\forall y[\neg Q(y) \wedge \neg \forall x \neg R(x, y)]$

$\forall y[\neg Q(y) \wedge \exists x R(x, y)]$

4.4 30e

$\neg \exists y[\forall x \exists z T(x, y, z) \vee \exists x \forall z U(x, y, z)]$

$\forall y[\neg \forall x \exists z T(x, y, z) \wedge \neg \exists x \forall z U(x, y, z)]$

$\forall y(\exists x \forall z \neg T(x, y, z) \wedge \forall x \exists z \neg U(x, y, z))$

p	q	r	$p \vee q$	$p \rightarrow r$	$q \rightarrow r$	$(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)$	$[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$
0	0	0	0	1	1	0	1
0	0	1	0	1	1	0	1
0	1	0	1	1	0	0	1
0	1	1	1	1	1	1	1
0	0	0	0	1	1	0	1
0	0	1	0	1	1	0	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1
1	0	0	1	0	1	0	1
1	0	1	1	1	1	1	1
1	1	0	1	0	0	0	1
1	1	1	1	1	1	1	1

Table 1: Table for Exercise 10d