

13/2

Question 1

a)	p	q	r	$\sim p$	$\sim r$	$q \vee \sim r$	$p \wedge (q \vee \sim r)$	$\sim p \wedge q$	$[p \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$
	T	T	T	F	F	T	T	F	F
	T	T	F	F	T	T	T	F	F
	T	F	T	F	F	F	F	F	T
	T	F	F	F	T	T	T	F	F
	F	T	T	T	F	T	F	T	T
	F	T	F	T	T	T	F	T	T
	F	F	T	T	F	F	F	F	T
	F	F	F	T	T	T	F	F	T

b) It is not a tautology because not all possible value of its propositional variables.

Question 2

a) i. $\sim p \wedge q$ ii. $p \vee \sim q$ b) $p \vee \sim q$

Question 3

a) $(\exists x \in A)(x + 3 = 10)$ b) $(\forall x \in A)(x + 3 < 10)$ c) $(\exists x \in A)(x + 3 < 5)$ d) $(\forall x \in A)(x + 3 \leq 7)$

False

True

True

False

Question 4

P: It is sunny this afternoon

Q: It is colder than yesterday

R: We will go swimming

S: we will play basketball

T: We will go home early

The hypotheses become

 ~~$\sim p \wedge Q, R \leftrightarrow P, \sim R \rightarrow S, S \rightarrow T$~~

Premises

p : It is sunny this afternoon

Q : It is colder than yesterday

R : we will go swimming

S : we will play basketball

conclusion

T : we will go home early

The hypotheses become $\sim p \wedge Q, R \leftrightarrow P, \sim R \rightarrow S, S \rightarrow T$ and conclusion T

(incomplete?)

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(14)

Question 1

a) $[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$

$\sim P$	P	q	r	$(q \vee \sim r)$	$P \wedge (q \vee \sim r)$	$(\sim P \wedge q)$	$[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$
F	T	T	F	T ✓	T ✓	F ✓	F ✓
F	T	T	T	T ✓	T ✓	F ✓	F ✓
F	T	F	F	F ✓	F ✓	F ✓	T ✓
F	T	F	T	T ✓	T ✓	F ✓	F ✓
T	F	T	F	T ✓	F ✓	T ✓	T ✓
T	F	T	T	T ✓	F ✓	T ✓	T ✓
T	F	F	F	F ✓	F ✓	F ✓	T ✓
T	F	F	T	T ✓	F ✓	F ✓	T ✓

(4)

b) modus

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Question 2

(a) i. $\sim P \wedge Q$ ✓

ii. $P \vee \sim Q$ ✓ (2)

b) i. False ✓

ii. True ✓ (2)

Question 3

a) $(\exists x \in A)(x+3 = 10) = \text{False}$ ✓

b) $(\forall x \in A)(x+3 < 10) = \text{True}$ ✓ (4)

c) $(\exists x \in A)(x+3 < 5) = \text{True}$ ✓

d) $(\forall x \in A)(x+3 \leq 7) = \text{False}$ ✓

Question 4

Let P be the proposition "It is sunny this afternoon", Q be the proposition "it is colder than yesterday", R be the proposition "we will go swimming", S be the proposition "we will play basketball", and T be the proposition "we go home early".

P = It is sunny this afternoon ✓

Q = It is colder than yesterday ✓

R = We will go swimming ✓

S = we will play basketball ✓ (1)

T = we go home early ✓

$\sim P \wedge Q, R \rightarrow P, \sim R \rightarrow S, S \rightarrow T$ and Conclusion $\neg T$. (1)

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No.

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Question 1.

a

$$[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$$

P	q	r	$\sim P$	$\sim r$	$q \vee \sim r$	$[P \wedge (q \vee \sim r)]$	$(\sim P \wedge q)$	$[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$
T	T	T	F	F	T	T	F	F
T	T	F	F	T	T	T	F	F
T	F	T	F	F	F	F	F	T
T	F	F	F	T	T	T	F	F
F	T	T	T	F	T	F	T	T
F	T	F	T	T	T	F	T	T
F	F	T	T	F	F	F	F	T
F	F	F	T	T	T	F	F	T

b) There are some possible values are false, then it is not a tautology.

Question 2

a) i) $\sim P \wedge Q$

ii) $P \vee \sim Q$

b)

P	Q	$\sim P$	$\sim P \wedge Q$
T	T	F	F
T	F	F	F
F	T	T	T
F	F	T	F

$P = T \quad Q = F$

$\therefore$ the true value is False

i)

P	Q	$\sim Q$	$P \vee \sim Q$
T	T	F	T
T	F	T	T
F	T	F	F
F	F	T	T

$\therefore$ the true value is true

Question 3

a) false ✓

b) true ✓

c) true ✓

d) false ✓

Question 4

Step 1:

Let P be the proposition "It is not sunny this afternoon", Q is "It is colder than yesterday", R is "We will go swimming", S is "We will play basketball" and T is "We will go home early".

Step 2:

 $\sim P \wedge Q$

(Premise 1 is false)

 $R \rightarrow P$

(Premise 2 is true)

 $\sim R \rightarrow S$

(Premise 3 is true)

 $\therefore S \rightarrow T$

(Conclusion is true and it is valid)

Step 3:

It is valid because because some premises are true and the conclusion must also be true

$\sim P \wedge Q$	$R \rightarrow P$	$\sim R \rightarrow S$	$S \rightarrow T$
T	T	T	T
T	T	F	T
T	F	T	F
T	F	F	F

$\sim P \wedge Q$	R	Q	P
T	T	T	T
T	T	F	T
T	F	T	F
T	T	F	F

Question 1

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Q1

incomplete

Q2	P	Q	R	$\neg R$	$\neg P$	$(\neg V \neg R)$	$\neg P \wedge Q$	$\neg P \wedge R$	$P \wedge (\neg V \neg R)$
	T	T	T	F	F	T	F	F	F
	T	T	F	T	F	T	F	F	F
	T	F	T	F	F	F	F	F	T
	T	F	F	T	F	T	F	F	F
	F	T	T	F	T	T	F	F	T
	F	T	F	T	T	T	F	F	T
	F	F	T	F	T	F	F	F	T
	F	F	F	T	T	T	F	F	T

Q3 F9/5e

Question 2

Q1 - $\neg P \wedge Q$

Q2 $P \vee \neg Q$

- Sarah is a student in polytechnic but is not the best institution in Malaysia
- CC is not the best institution in Malaysia or Sarah is a student in polytechnic

Question 3

a F

b T

c T

d F

Questions 4

- h1 It is not sunny the afternoon - P
- h2 It is colder than yesterday - Q
- h3 We will go swimming - R
- h4 We will play basketball - S

$\neg P \wedge Q$

$R \leftrightarrow P$

$\neg R \rightarrow S$

$S \rightarrow T$

$\therefore T$

T = ?

How?

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Question 1

a)	P	q	r	$\sim P$	$\sim r$	$q \vee \sim r$	$\sim P \wedge q$	$P \wedge (q \vee \sim r)$	$[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$
	T	T	T	F	F	T	F	T	F
	T	T	F	F	T	T	F	T	F
	T	F	T	F	F	F	F	F	T
	T	F	F	F	T	T	F	T	T
	F	T	T	T	F	T	T	F	F
	F	T	F	T	T	T	T	F	F
	F	F	T	T	F	F	F	F	T
	F	F	F	T	T	T	F	F	T

b) - modus Tollens

3

Question 2

- a) i) $\sim P \vee q$
 ii) $P \vee (\sim q)$

- b) i) False
 ii) True

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Question 3

- a) False
 b) True
 c) False
 d) False

3

Question 4

Let p be the proposition "It is sunny this afternoon", q be the proposition "It is colder than yesterday", r is the "we will go to swimming", s be the proposition "we will play basketball" and t be the proposition "we go home early".

Then, the hypotheses become $\neg p \wedge q$, $r \rightarrow p$, $\neg r \rightarrow ?$, and $s \rightarrow t$ and conclusion t .

Incomplete

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Question 3

a) $(\exists x \in A) (x+3 = 10)$

False

b) $(\forall x \in A) (x+3 < 10)$

True

c) $(\exists x \in A) (x+3 < 5)$

True

d) $(\forall x \in A) (x+3 < 7)$

False

Question 4

Let p be the proposition "It is sunny this afternoon", q be the proposition "it is colder than yesterday", R be the proposition "we will go swimming", s be the proposition "we will play basketball", and t be the proposition "we go home early".

premis

 p - It is sunny this afternoon q - it is colder than yesterday R - we will go swimming s - we will play basketball

conclusion

 t - we go home early

$$\sim p \wedge q, R \leftrightarrow p, \neg \sim R \rightarrow s, s \rightarrow t$$

conclusion t.

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Question 1

a) Construct a truth table for the following statement.

$$[P \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$$

P	q	r	$\sim P$	$\sim R$	$q \vee \sim r$	$\sim p \wedge q$	$[P \wedge (q \vee \sim r)]$	$[P \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$
T	T	T	F	F	T	F	T	T
T	T	F	F	T	T	F	T	T
T	F	T	F	F	F	F	F	T
T	F	F	F	T	T	F	T	T
F	T	T	T	F	T	T	F	F
F	T	F	T	T	T	T	F	F
F	F	T	T	F	F	F	F	T
F	F	F	T	T	T	F	F	T

3

b) Identify any tautology.

Modus tollens

Question 2

a) Express each of the following compound statements in symbolic form.

i. sarah not a student at polytechnic but cc is the best institution Malaysia

$$\sim P \wedge Q$$

ii. sarah is a student at polytechnic or cc is not best institution in malaysia

$$P \vee \sim Q$$

b) i) # False

ii) True

Question 1

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a) $[p \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$

p	q	r	$\sim r$	$q \vee \sim r$	$p \wedge (q \vee \sim r)$	$\sim p$	$(\sim p \wedge q)$	$[p \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$
T	T	T	F	T	T	F	F	F
T	T	F	T	T	T	F	F	F
T	F	T	F	F	F	F	F	T
T	F	F	T	T	T	F	F	F
F	T	T	F	T	F	T	T	T
F	T	F	T	T	F	T	T	T
F	F	T	F	F	F	T	F	T
F	F	F	T	T	F	T	F	T

not

b) Since all possible values for proposition variables are true, so it is ^{not} a tautology.

Question 2

a) i) $\sim p \wedge q$

ii) $p \vee \sim q$

b) i) $\sim p \wedge q$

$\sim \text{true} \wedge \text{false}$

$\text{false} \wedge \text{false}$

false

ii) $p \vee \sim q$

$\text{True} \vee \sim \text{false}$

$\text{True} \vee \text{True}$

True

Question 3

$$a) (\exists x \text{ EA}) (x+3 = 10)$$

$$= \text{False}$$

$$b) (\forall x \text{ EA}) (x+3 < 10)$$

$$= \text{True}$$

$$c) (\exists x \text{ EA}) (x+3 \geq 5)$$

$$= \text{True}$$

$$d) (\forall x \text{ EA}) (x+3 \leq 7)$$

$$= \text{False}$$

Question 4

Step 1: $p = \text{It is } \textcircled{\text{not}} \text{ Sunny this afternoon}$
 $q = \text{It is colder than yesterday}$
 $r = \text{we will go swimming}$
 $s = \text{we will play basketball}$
 $t = \text{we will go home early}$

Step 2 = Premis

 $p \rightarrow \text{It is Sunny this afternoon}$ $q \rightarrow \text{It is colder than yesterday}$ $r \rightarrow \text{we will go swimming}$ $s \rightarrow \text{we will play basketball}$ $t \rightarrow \text{we will go home early}$ ~~Conclusion $\rightarrow$ we will go home early~~Hypotheses

1. $\sim p \wedge q$

2. $r \rightarrow p$

3. $\sim r \rightarrow s$

4. $s \rightarrow t$

Step 3 : Inferences

Hypothesis	Step
$\sim P \wedge Q$ ✓	1
$\sim P$ ✓	2
$r \rightarrow P$ ✓	3
$\sim r$ ✓	4
$\sim r \rightarrow S$ ✓	5
S ✓	6
$S \rightarrow T$ ✓	7
Conclusion T ✓	8

Reason

 ~~$\sim P \wedge Q$~~ Premise ~~$\sim P$~~ simplification using (1) and (2). $r \rightarrow P$ Premise.

modus tollens using (2) and (3)

premise
modus ponens using (4) and (5) $S \rightarrow T$

modus ponens using (6) and 7.

Hypothesis

(1) $\rightarrow$ using simplification(2) $\rightarrow$ using modus tollens(3) $\rightarrow$ using modus ponens(4) $\rightarrow$ using modus ponensConclusion $\rightarrow$ we go home early

(4)

Follow the ways suggested.

Question 1

(a) Construct a truth table for the following statement.

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

p	q	r	$\sim r$	$q \vee \sim r$	$p \wedge (q \vee \sim r)$	$\sim p$	$(\sim p \wedge q)$	$[p \wedge (q \vee \sim r)] \rightarrow (\sim p \wedge q)$
T	T	T	F	T	T	F	F	F
T	T	F	T	T	T	F	F	F
T	F	T	F	F	F	F	F	T
T	F	F	T	T	T	F	F	F
F	T	T	F	T	F	T	T	T
F	T	F	T	T	F	T	T	T
F	F	T	F	F	F	T	F	T
F	F	F	T	T	F	T	F	T

(b) Identify any tautology

→ It is not a tautology because not all possible value of its propositional variables.

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Flow

Question 2

p : Sarah is a student in polytechnic. $\{T, F, S, C, I\} = A \cup B$

q : CC is the best institution in Malaysia.

(a) Express each of the following compound statements in symbolic form.

(i) Sarah is not a student at polytechnic but CC is the best institution in Malaysia.

$$\neg p \wedge q$$

(1)

(ii) Sarah is a student at polytechnic or CC is not the best institution in Malaysia

$$p \vee \neg q$$

(1)

b. Suppose that the statement p is true and q is false.

Determine the truth value for (i) and (ii)

p : True q : False

(i)

True $\wedge$ False

False

(2)

(ii)

True $\vee$ False

True.

Question 3

Let $A = \{1, 2, 3, 4, 5\}$. Determine the truth value of the following statements.

(a) $(\exists x \in A) (x+3 = 10)$

False ✓

(b) $(\forall x \in A) (x+3 < 10)$

True ✓

(c) $(\exists x \in A) (x+3 < 5)$

True ✓

(d) $(\forall x \in A) (x+3 \leq 7)$

False ✓

Question 4

Step 1

 p : It is sunny this afternoon. q : ^{It is} colder than yesterday r : We will go swimming s : We will play basketball T : We will go home early

(1)

Step 2.

Step	Reason
$\neg p \wedge q$ ✓	Hypothesis <u>Premise</u> ✓
$\neg p$ ✓	Simplification using (1) ✓
$r \rightarrow p$ ✓	Hypothesis <u>Premise</u> ✓
$\neg r$ ✓	Modus Tollens using (2) and (3) ✓
$\neg r \rightarrow s$ ✓	Hypothesis <u>Premise</u> ✓
s ✓	Modus Ponens using (4) and (5) ✓
$s \rightarrow T$ ✓	Hypothesis <u>Premise</u> ✓
T ✓	Modus Ponens using (6) and (7) ✓

If

Step 3.

- Then, the hypothesis become $\neg p \wedge q$, $r \rightarrow p$, $\neg r \rightarrow s$ and $s \rightarrow T$ and conclusion T which is "we go home early".

Question 4

Step 1

P : It is sunny this afternoon.

q : ^{It is} colder than yesterday

r : We will go swimming

s : We will play basketball

T : We will go home early

(1)

Step 2.

Step	Reason
$\neg P \wedge q$ ✓	<u>Hypothesis</u> Premise
$\neg P$ ✓	Simplification using (1)
$r \rightarrow P$ ✓	<u>Hypothesis</u> Premise
$\neg r$ ✓	Modus Tollens using (2) and (3)
$\neg r \rightarrow s$ ✓	<u>Hypothesis</u> Premise
s ✓	Modus Ponens using (4) and (5)
$s \rightarrow T$ ✓	<u>Hypothesis</u> Premise
T ✓	Modus Ponens using (6) and (7)

If

Step 3.

Then, the hypothesis become $\neg P \wedge q$, $r \rightarrow P$, $\neg r \rightarrow s$ and $s \rightarrow T$ and conclusion T which is "we go home early".

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Question 1

(a)

P	q	r	$\sim p$	$\sim r$	$q \vee \sim r$	$P \wedge (q \vee \sim r)$	$\sim P \wedge q$	$[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$
T	T	T	F	F	T	T	F	F
T	T	F	F	T	T	T	F	F
T	F	T	F	F	F	F	F	T
T	F	F	F	T	T	T	F	F
F	T	T	T	F	T	F	T	T
F	T	F	T	T	T	F	T	T
F	F	T	T	F	F	F	F	T
F	F	F	T	T	T	F	F	T

(b) Not tautology because the final value is not all TRUE.

Question 2

(a) (i) $\sim P \wedge Q$ (ii) $P \vee \sim Q$

(b) (i) False

(ii) True

Question 3

(a) False ✓

(b) True ✓

(c) True ✓

(d) False ✓

Question 4

Let P be the proposition "It is sunny this afternoon", Q be the proposition "It is colder than yesterday", R be the proposition "We will go swimming", S be the proposition "We will play basketball" and T be the proposition "We will go home early".

$\neg P \wedge Q$, $R \leftrightarrow P$, $\neg R \rightarrow S$, and $S \wedge T$

Step	Reason	
1. $\neg P \wedge Q$	Hypothesis	$\neg P \wedge Q$
2. $\neg P$	Simplification using (1)	$\therefore \neg P$
3. $R \leftrightarrow P$	Hypothesis	$\sim Q$
4. $\neg R$	Modus Tollens using (2) and (3)	$P \rightarrow Q$
5. $\neg R \rightarrow S$	Hypothesis	$\therefore \neg P$
6. S	Modus Ponens using (4) and (5)	$P \rightarrow Q$
7. $S \wedge T$	Hypothesis	$P \rightarrow Q \sim (i) (ii)$
8. T	Modus ponens using (6) and (7)	$\therefore Q \vee P (iii)$

3 ✓