

Question 1

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) $\sim p \wedge q$

$\sim$ true $\wedge$ false

false $\wedge$ false

false

ii) $p \vee \sim q$

True $\vee$ false

True $\vee$ True

True

Question 3

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

= False

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

= True

c) $(\exists x \text{ EA})(x+3 \leq 5)$ (4)

= True

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

= False

Question 4

Step 1: $p = It$ is ~~not~~ 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

Step 2: Premis

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

 $\sim P \wedge Q$ $\sim P$ $r \rightarrow p$ $\sim r$ $\sim r \rightarrow s$ s $s \rightarrow T$ Conclusion T

Step

1

2

3

4

5

6

7

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).

 $s \rightarrow T$

implication 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

Follow the ways suggested.

A.

(4)

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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".

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

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

3 1/2

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

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(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

(ii)

True $\vee$ False

True.

(2)

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 Premise
$\neg P$ ✓	Simplification using (1)
$r \rightarrow P$ ✓	Hypothesis Premise
$\neg r$ ✓	Modus Tollens using (2) and (3)
$\neg r \rightarrow s$ ✓	Hypothesis Premise
s ✓	Modus Ponens using (4) and (5)
$s \rightarrow T$ ✓	Hypothesis 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

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

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

ii)	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	F
T	F	T	T
T	F	F	F

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

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(14)

Question 1

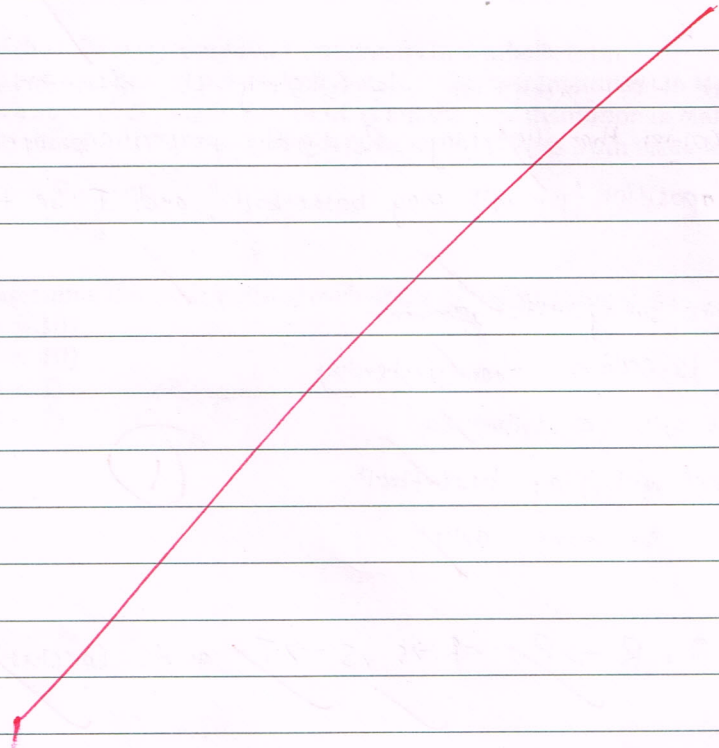
a) $[P \wedge (q \vee \sim r)] \rightarrow (\sim P \wedge q)$

$\sim P$	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 tollens

no penal!



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 T. (1)

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12

Question 1

a) Construct a truth table for the following statement.

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

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

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b) Identify any tautology

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

2

Question 2.

P: Sarah is a student in ~~polytec~~ polytechnic

Q: CC is the best institution in Malaysia.

a) i) Sarah is not a student at polytechnic but CC is the best institution
 $= \neg P \wedge Q$

ii) Sarah is a student at polytechnic or CC is not the best institution
 $= P \vee \neg Q$

2

b) (ii) $P \vee \neg Q$

6

Question 3

a) False ✓

b) True ✓

c) True ✓

d) False ✓

(4)

Question 4.

 P = It is not sunny this afternoon Q = It is colder than yesterday R = We will go swimming only if it is sunny S = If we do not go swimming, we will play basketball T = If we play basketball, we will go home early.

Step 1.

Let P be the proposition "It is not 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".

Step 2

 P = it is not sunny this afternoon Q = it is colder than yesterday R = We will go swimming only if it is sunny S = ... swimming, we will play basketball T = We will go home early.

Step 3 ✓

 $R \rightarrow P$

$\sim P \wedge Q, R \rightarrow P, \sim R \rightarrow S$ and $S \rightarrow T$ and conclusion T .

incomplete!

Q Question 1

10 1/2

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 $\sim p \wedge q$, $r \rightarrow p$, $\sim r \rightarrow ?$, and $s \rightarrow t$ and conclusion t .

Incomplete

Q1

Question 1

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incomplete
Q1

Q2	P	Q	R	$w \vee R$	$w \vee P$	$(Q \vee w \vee r)$	$\neg P \wedge Q$	$w \vee P \wedge Q$	$P \wedge (Q \vee w \vee r) \rightarrow m$
	T	T	T	F	F	T	T	F	F
	T	T	F	T	F	T	T	F	F
	T	F	T	F	F	F	F	F	T
	T	F	F	T	F	T	T	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

63 False

4

3 1/2

Question 2

91 - P $\wedge$ Q

62 P $\vee$ m Q

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

$m \vee P \wedge Q$
 $R \leftrightarrow P$
 $m \vee R \rightarrow S$
 $S \rightarrow T$
 $\therefore T$

How?
T = ?