



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai

Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &

Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)

COIMBATORE-641 035, TAMIL NADU



DEPARTMENT OF MATHEMATICS

1. Show that $(\exists x) M(x)$ follows logically
from $(x) [H(x) \rightarrow M(x)], (\exists x) H(x)$

Step	Premises	Rule
1.	$(x) [H(x) \rightarrow M(x)]$	P
{1}	2. $H(y) \rightarrow M(y)$	US
	3. $(\exists x) H(x)$	P
{3}	4. $H(y)$	ES
	5. $M(y)$	T $P, P \rightarrow Q \Rightarrow Q$
{2,4}	6. $(\exists x) M(x)$	EG

2. All humans are mortal. Sachin is a human
Therefore he is mortal.

$H(x)$: x is a human

$M(x)$: x is mortal

$H(s)$: Sachin is a human

The premises are,

$(\forall x) [H(x) \rightarrow M(x)], H(s)$

Conclusion: $M(s)$

Step	Premises	Rule
1.	$(\forall x) [H(x) \rightarrow M(x)]$	P
{1}	2. $H(s) \rightarrow M(s)$	US
	3. $H(s)$	P
{2,3}	4. $M(s)$	T $P, P \rightarrow Q \Rightarrow Q$

3. Show that the premises, "one student in this
class knows how to write programs in JAVA" &
"Everyone who knows how to write program in
JAVA can get a high-paying job" imply the
conclusion "someone in this class can get a
high-paying job".



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Let $A(x)$: x is in this class
 $J(x)$: x knows how to write program in JAVA
 $H(x)$: x can get a high paying job.

The premises are,

$$[\exists x] (A(x) \wedge J(x)), \quad (\forall x) (J(x) \rightarrow H(x))$$

Conclusion: $\exists x (A(x) \wedge H(x))$

Step	Premises	Rule
1.	$(\exists x) (A(x) \wedge J(x))$	P
{1} 2.	$A(y) \wedge J(y)$	E \exists
{2} 3.	$A(y)$	T $A(y) \wedge J(y) \Rightarrow A(y)$
{2} 4.	$J(y)$	T $A(y) \wedge J(y) \Rightarrow J(y)$
5.	$(\forall x) (J(x) \rightarrow H(x))$	P
{5} 6.	$J(y) \rightarrow H(y)$	US
7.	$H(y)$	T
{3, T} 8.	$A(y) \wedge H(y)$	T $A(y), H(y) \Rightarrow A(y) \wedge H(y)$
9.	$(\exists x) (A(x) \wedge H(x))$	EG

Q7. Verify the validity of the following argument.
 "Every living thing is a plant or an animal"
 "John's gold fish is alive and it is not a plant"
 "All animals have hearts". Therefore, "John's gold fish has a heart".

$L(x)$: x is a living thing $L(j)$: j is alive
 $P(x)$: x is a plant $P(j)$: j is not a plant
 $A(x)$: x is an animal
 $H(x)$: x is a heart $H(j)$: j has a heart

Given: $(\forall x) [L(x) \rightarrow P(x) \vee A(x)]$
 $L(j) \wedge \neg P(j), (\forall x) [A(x) \rightarrow H(x)]$



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conclusion: $H(j)$

Step	Propositions	Rule
1.	$(\forall x) [L(x) \rightarrow P(x) \vee A(x)]$	P
{1} 2.	$L(j) \rightarrow P(j) \vee A(j)$	US
3.	$L(j) \wedge \neg P(j)$	P
{3} 4.	$L(j)$	T $P \wedge Q \Rightarrow P$
{2,4} 5.	$P(j) \vee A(j)$	T $P, P \rightarrow Q \Rightarrow Q$
{5} 6.	$\neg P(j) \rightarrow A(j)$	T $P \wedge \neg Q \Rightarrow \neg P \vee Q$
7.	$(\forall x) [A(x) \rightarrow H(x)]$	P
{8} 8.	$A(j) \rightarrow H(j)$	US
9.	$\neg P(j) \rightarrow H(j)$	T
{3} 10.	$\neg P(j)$	T $P \wedge Q \Rightarrow P, Q$
11.	$H(j)$	T $P, P \rightarrow Q \Rightarrow Q$

5]. "All loud music is loud music", "some loud music exist" therefore "some loud music exist"

$R(x)$: x is a loud music
 $L(x)$: x is a loud music

Given: $(\forall x) [R(x) \rightarrow L(x)]$, $(\exists x) R(x)$

conclusion: $(\exists x) L(x)$

1.	$(\forall x) (R(x) \rightarrow L(x))$	P
{1} 2.	$R(y) \rightarrow L(y)$	US
3.	$(\exists x) R(x)$	P
{3} 4.	$R(y)$	ES
{2,4} 5.	$L(y)$	T
6.	$(\exists x) L(x)$	EG

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6]. Establish the validity of argument.

- i). All integers are rational nos.
- ii) Some integers are power of three.
- iii) Therefore some rational numbers are power of 3.

$I(x)$: x is an integer

$R(x)$: x is an rational number

$P(x)$: x is power of 3.

Given, $(\forall x) (I(x) \rightarrow R(x))$, $(\exists x) (I(x) \wedge P(x))$

Conclusion: $(\exists x) [R(x) \wedge P(x)]$

Step	Premises	Rule
1.	$(\forall x) [I(x) \rightarrow R(x)]$	P
{1} 2.	$I(y) \rightarrow R(y)$	US
3	$(\exists x) [I(x) \wedge P(x)]$	P
{3} 4.	$I(y) \wedge P(y)$	ES
{4} 5.	$I(y)$	T $P \wedge Q \Rightarrow P$
{2, 5} 6.	$R(y)$	T $P, P \rightarrow Q \Rightarrow Q$
{4} 7.	$P(y)$	T $P \wedge Q \Rightarrow Q$
{6, 7} 8.	$R(y) \wedge P(y)$	T $P, Q \Rightarrow P \wedge Q$
9.	$(\exists x) [R(x) \wedge P(x)]$	EG

7]. Show that $(\forall x) [P(x) \vee Q(x)] \Rightarrow (\exists x) P(x) \vee (\forall x) Q(x)$
by indirect proof.

Premises: $(\forall x) [P(x) \vee Q(x)]$

Conclusion: $(\exists x) P(x) \vee (\forall x) Q(x)$



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Step	Premises	Rule
1.	$(x) [P(x) \vee Q(x)]$	P US
{3} 2.	$P(y) \vee Q(y)$	
3.	$\neg [(x) P(x) \vee (x) Q(x)]$	Negation of conclusion T $\neg(P \wedge Q) \Leftrightarrow \neg P \vee \neg Q$
{3} 4.	$(x) \neg P(x) \wedge (x) \neg Q(x)$	T $P \wedge Q \Rightarrow P$
{4} 5.	$(x) \neg P(x)$	ES
{5} 6.	$\neg P(y)$	T $P \wedge Q \Rightarrow Q$
7.	$(x) \neg Q(x)$	US
{7} 8.	$\neg Q(y)$	T $P, Q \Rightarrow P \wedge Q$
{6,8} 9.	$\neg P(y) \wedge \neg Q(y)$	T $\neg P \wedge \neg Q \Leftrightarrow \neg(P \vee Q)$
{9} 10.	$\neg(P(y) \vee Q(y))$	T $P, Q \Rightarrow P \wedge Q$
{9,10} 11.	$[P(y) \vee Q(y)] \wedge \neg[P(y) \vee Q(y)]$	T $P \wedge \neg P \Leftrightarrow F$
{11} 12.	F	

8]. Using CP rule, obtain the following implication
 $(\forall x) [P(x) \rightarrow Q(x)], (\forall x) [R(x) \rightarrow \neg Q(x)] \Rightarrow R(x) \rightarrow \neg P(x)$

Step	Premises	Rule
1.	$(\forall x) [P(x) \rightarrow Q(x)]$	P
2.	$(\forall x) [R(x) \rightarrow \neg Q(x)]$	P
{2} 3.	$R(y) \rightarrow \neg Q(y)$	US
4.	$R(y)$	P (assumed)
{3,4} 5.	$\neg Q(y)$	T $P, P \rightarrow Q \Rightarrow Q$
{5} 6.	$P(y) \rightarrow Q(y)$	US
{5,6} 7.	$\neg P(y)$	T $P \rightarrow Q, \neg Q \Rightarrow \neg P$



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{4,7} 8. $R(y) \rightarrow \neg P(y)$

{8} 9. $(\forall x) [R(x) \rightarrow \neg P(x)]$

CP

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