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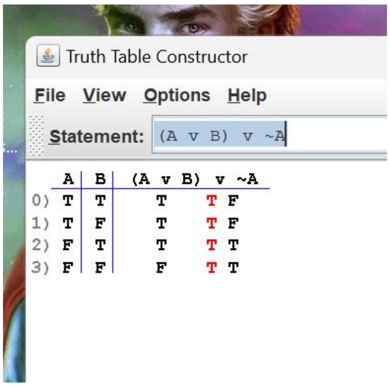
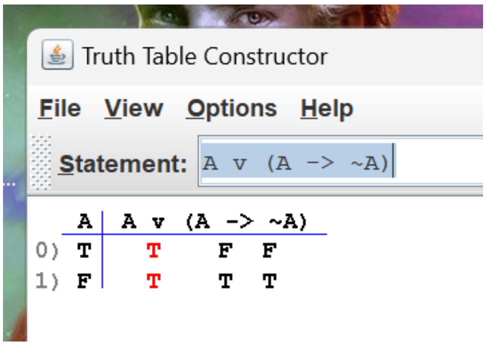
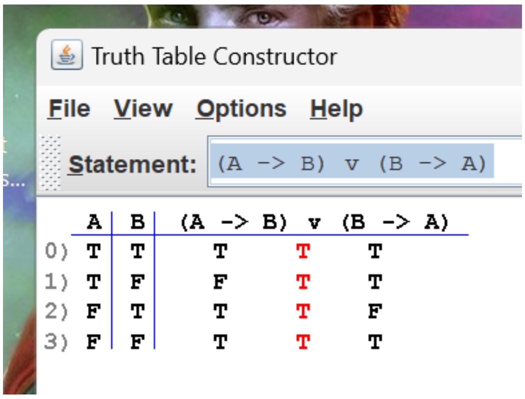
1)



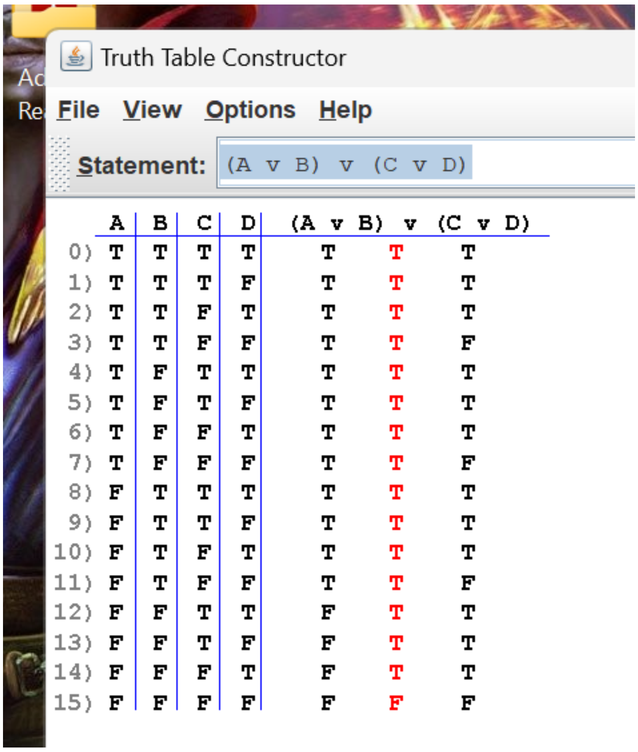
	A	B	(A v B)	v	~A
0)	T	T	T	T	F
1)	T	F	T	T	F
2)	F	T	T	T	T
3)	F	F	F	T	T



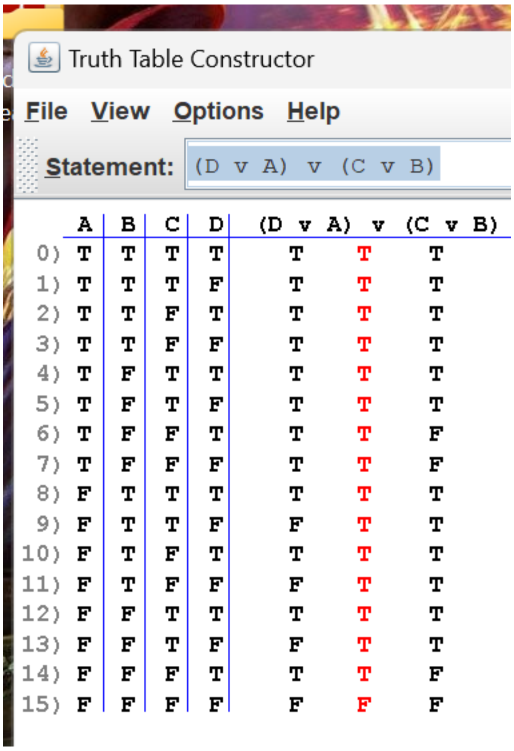
	A	A v	(A ->	~A)
0)	T	T	F	F
1)	F	T	T	T



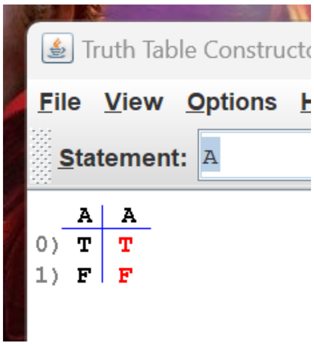
	A	B	(A -> B)	v	(B -> A)
0)	T	T	T	T	T
1)	T	F	F	T	T
2)	F	T	T	T	F
3)	F	F	T	T	T

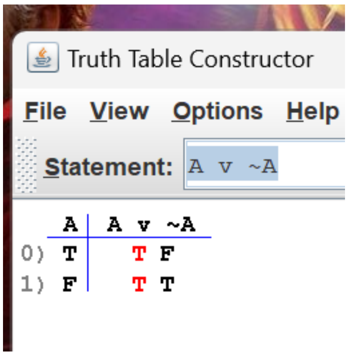


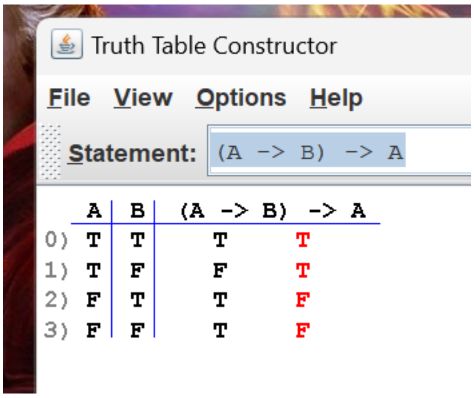
	A	B	C	D	(A v B)	v	(C v D)
0)	T	T	T	T	T	T	T
1)	T	T	T	F	T	T	T
2)	T	T	F	T	T	T	T
3)	T	T	F	F	T	T	F
4)	T	F	T	T	T	T	T
5)	T	F	T	F	T	T	T
6)	T	F	F	T	T	T	T
7)	T	F	F	F	T	T	F
8)	F	T	T	T	T	T	T
9)	F	T	T	F	T	T	T
10)	F	T	F	T	T	T	T
11)	F	T	F	F	T	T	F
12)	F	F	T	T	F	T	T
13)	F	F	T	F	F	T	T
14)	F	F	F	T	F	T	T
15)	F	F	F	F	F	F	F



	A	B	C	D	(D v A)	v	(C v B)
0)	T	T	T	T	T	T	T
1)	T	T	T	F	T	T	T
2)	T	T	F	T	T	T	T
3)	T	T	F	F	T	T	T
4)	T	F	T	T	T	T	T
5)	T	F	T	F	T	T	T
6)	T	F	F	T	T	T	F
7)	T	F	F	F	T	T	F
8)	F	T	T	T	T	T	T
9)	F	T	T	F	F	T	T
10)	F	T	F	T	T	T	T
11)	F	T	F	F	F	T	T
12)	F	F	T	T	T	T	T
13)	F	F	T	F	F	T	T
14)	F	F	F	T	T	T	F
15)	F	F	F	F	F	F	F







2)

{1,3,5,7,9,11,....}U{2,4,6,8,10,....}=N as it forms a set of all natural numbers.

U = {1,2,3, ……, 6, 7, 8}, so $\{1,3,5,7,9\}^c$ = {2,4,6,8} as complement of a set U means elements that belongs to the set U but are not in the complement set (1,3,5,7,9) .

A= {1,3,5,7,9}, B={2,4,6,8} and C={1,2,3,4} so (A U B) = {1,2,3,4,5,6,7,8,9} not {1,2,3,4}.

{a,b,c,d,e}∩{a,e,i,o,u}={a,e} as the intersection checks for elements that are common in both sets which are a and e.

(X∩Y)UZ=(XUY)∩Z is not valid as intersection and union are not the same and they have very different set results.

{1,2,3,4,5}∩{1,4,8,12}={1,4} as 1 and 4 are common in both sets. So the statements {1,2,3,4,5}∩{1,4,8,12} is not equal to {1,2,3,4,5,8,12} as it does union instead.

3)
{1,2,3,1,2,3,1,2,3}={1,2,3} set does not count duplicates

$\{n \in N : n^2 = 25\} = \{5\}$ as the only natural number when squared to give 25 is 5. The set elements have to be represented in a set not by itself.

{2n:n∈{1,2,3,....}}={2,4,6,....} as 2 times the set elements give 2*1, 2*2, 2*3 = {2,4,6}. The set elements have to be represented in a set not by itself.

4)

A∩(B∪C)=(A∩B)∪C due to associative law.

(A\B)∪(B\A)=A∪B is not valid as the symmetric difference of sets A and B, denoted by A ⊕ B.

(A∩Ac)∪(B∩Bc)=∅ as AnA^c will be an empty set same as the other side resulting in a union of empty sets which is an empty set.

A∩B=(Ac)c∪B is not valid as the complement of A Complement is A so AnB is not = AUB.

A∪(B∩C)=(B∪A)∩(A∪C) as it represent distribution law.

A∩(B∪C)∩D=(A∩B)∪(C∩D) is not valid as it does not follow any law and D would always be separate.

(A\B)∩(B\A)={} as for example if A = {1,2} and B = {2,3} the (A\B) is {1} and (B\A) = {3} resulting in no common elements so it is an empty set.

A∪B⊆A∩B is not valid as it the union cannot be a subset of an intersection.

5)

|{{1,2,3},{1,3,2},{2,1,3},{3,2,1}}| = 1 as there is only one distinct set although in different order

|{1,2,3,4,4,5,5}|=5 as there are 5 distinct elements, the rest are duplicates.

|{6,6,6,6,6,6}|=1 as there is only 1 distinct element so cardinality is 1.

|{a,b,c}|=3 as there are 3 distinct elements

{1,2,3}=3 is not valid as this is just a normal set that does not ask for the cardinality.

6)

The relation N is symmetric, reflexive and transitive as it is reflexive as a person (a) has the same name as themselves. It is symmetric as if a has the same name as b then b obviously has the same name as a. It is transitive as if a has the same name as b and b has the same c then a obviously has the same name as c.

The relation S is transitive as if a is shorter than b and b is shorter than c then a is obviously shorter than c. It is not reflexive a cannot be shorter than a. It is not symmetric as a is shorter than b so b is definitely not shorter than a.

The relation M is symmetric as if a is married to b then b is married to a. M is not reflexive as a person cannot be married to themselves. M is not transitive as if a is married to b and b is married to c then it does not mean a is married to c.

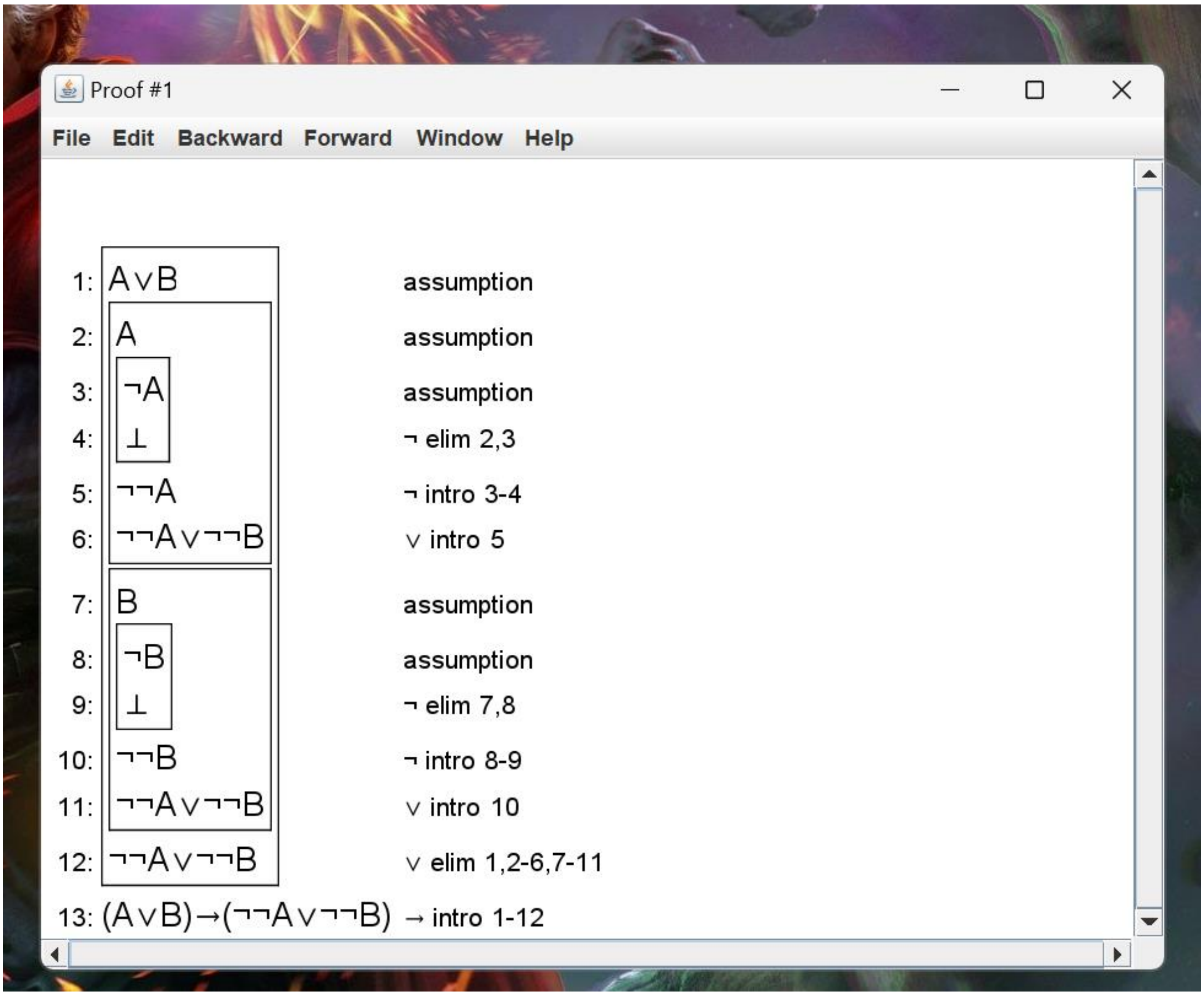
7)

The relation S is transitive as if a is shorter than b and b is smaller than c then a is obviously shorter than c. It is not reflexive a cannot be smaller than a. It is not symmetric as a is smaller than b so b is definitely not smaller than a.

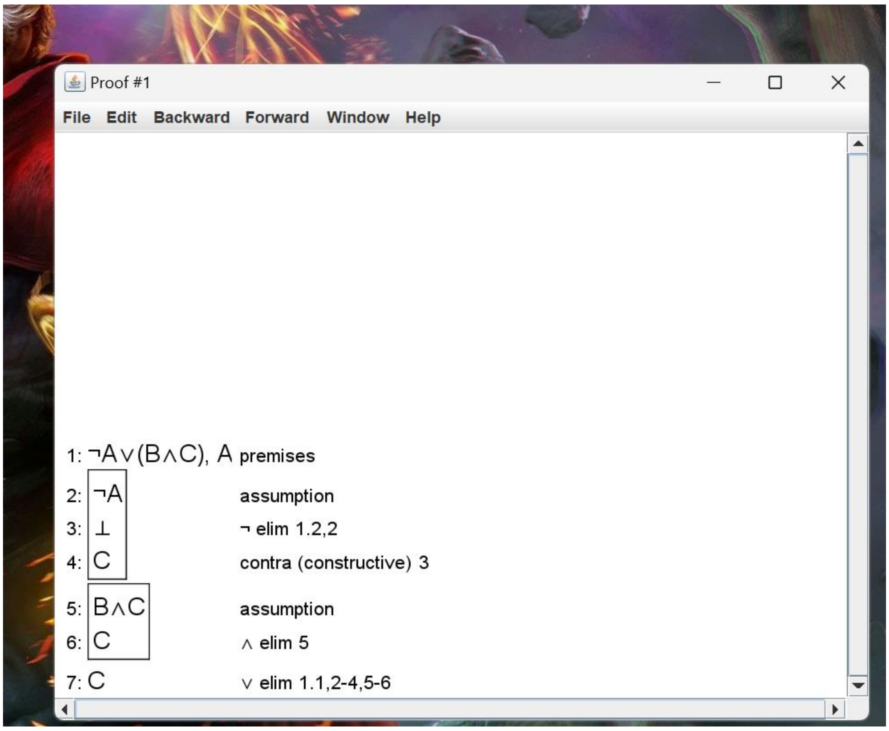
The relation E is symmetric, reflexive and transitive as if x has the same number of letters as y then y has the same number of letters as x, it is reflexive as x will have the same number of letters as x and it is transitive as if x has the same number of letters as y and y has the same number of letters as z then x has the same number of letters as z.

The relation D is symmetric as if a + b is 10 then b + a is also 10. D is not reflexive as a + a cannot be 10 and it is not transitive as if a + b is 10 and b + c then it does not mean a + c is 10.

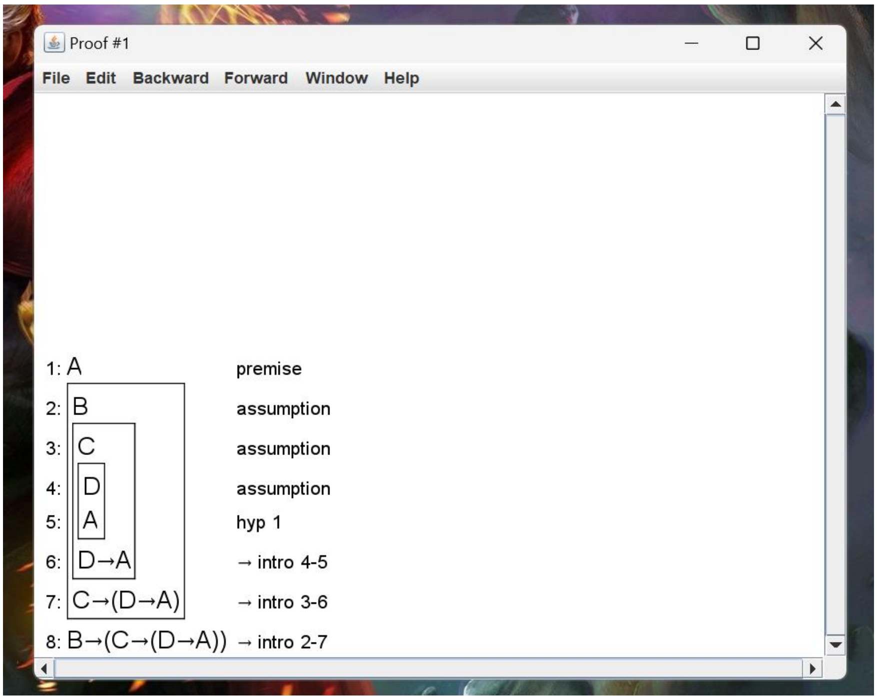
10)



11)


Proof #1
File Edit Backward Forward Window Help
1: ¬A∨(B∧C), A premises
2: ¬A assumption
3: ⊥ ¬ elim 1.2,2
4: C contra (constructive) 3
5: B∧C assumption
6: C ∧ elim 5
7: C ∨ elim 1.1,2-4,5-6

12)


Proof #1
File Edit Backward Forward Window Help
1: A premise
2: B assumption
3: C assumption
4: D assumption
5: A hyp 1
6: D→A → intro 4-5
7: C→(D→A) → intro 3-6
8: B→(C→(D→A)) → intro 2-7

13)

Proof #1

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1:	$\neg((A \to B) \vee (B \to A))$	assumption
2:	A	assumption
3:	B	assumption
4:	A	hyp 2
5:	$B \to A$	$\to$ intro 3-4
6:	$(A \to B) \vee (B \to A)$	$\vee$ intro 5
7:	$\perp$	$\neg$ elim 6,1
8:	B	contra (constructive) 7
9:	$A \to B$	$\to$ intro 2-8
10:	$(A \to B) \vee (B \to A)$	$\vee$ intro 9
11:	$\perp$	$\neg$ elim 10,1
12:	$((A \to B) \vee (B \to A))$	contra (classical) 1-11

14)

1:	$(A \lor B) \lor (C \lor D)$	assumption
2:	$A \lor B$	assumption
3:	A	assumption
4:	$A \lor C$	$\lor$ intro 3
5:	$(B \lor D) \lor (A \lor C)$	$\lor$ intro 4
6:	B	assumption
7:	$B \lor D$	$\lor$ intro 6
8:	$(B \lor D) \lor (A \lor C)$	$\lor$ intro 7
9:	$(B \lor D) \lor (A \lor C)$	$\lor$ elim 2,3-5,6-8
10:	$C \lor D$	assumption
11:	C	assumption
12:	$A \lor C$	$\lor$ intro 11
13:	$(B \lor D) \lor (A \lor C)$	$\lor$ intro 12
14:	D	assumption
15:	$B \lor D$	$\lor$ intro 14
16:	$(B \lor D) \lor (A \lor C)$	$\lor$ intro 15
17:	$(B \lor D) \lor (A \lor C)$	$\lor$ elim 10,11-13,14-16
18:	$(B \lor D) \lor (A \lor C)$	$\lor$ elim 1,2-9,10-17
19:	$((A \lor B) \lor (C \lor D)) \to ((B \lor D) \lor (A \lor C))$	$\to$ intro 1-18

15)

1:	$\neg\neg(A \vee \neg A) \rightarrow (A \vee \neg A)$	premise
2:	$\neg(A \vee \neg A)$	assumption
3:	A	assumption
4:	$A \vee \neg A$	$\vee$ intro 3
5:	$\perp$	$\neg$ elim 4,2
6:	$\neg A$	$\neg$ intro 3-5
7:	$A \vee \neg A$	$\vee$ intro 6
8:	$\perp$	$\neg$ elim 7,2
9:	$\neg\neg(A \vee \neg A)$	$\neg$ intro 2-8
10:	$A \vee \neg A$	$\rightarrow$ elim 1,9