## Pontifícia Universidade Católica do Paraná

Disciplina: Resolução de Problemas com Lógica Matemática (RPLM) Lista de Exercícios 8

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#### 1) Construa as deduções:

a) 
$$\{(p \rightarrow q), (p \land r)\} \models q$$

b) 
$$\{(p \land q), ((p \lor r) \rightarrow s)\} \models (p \land s)$$

c) 
$$\{(p \rightarrow (q \rightarrow r)), (p \rightarrow q), p\} \models r$$

```
D I LPVQ) +>R
2 LIRVQ) +> (S4+>t)))
3 PAS

4 P Simplificação I
5 PVQ Adição 4
6 R Modes Powers 1,5
7 RVQ Adição 6
8 P-> (S4+>t) Modes Powers 2,6
9 (S4->t) Modes Powers 8,4
```

e)  $\{(p \rightarrow \neg q), (\neg p \rightarrow (r \rightarrow \neg q)), ((\neg s \lor \neg r) \rightarrow \neg \neg q), \neg s\} \models \neg r$ 

```
E) { (P+7Q), (TP+(R+7Q)), ((TSVTR)+7TQ), TS} = TR

1. P+TQ hip.
2. TP+(R+TQ) hip.
3. (TSVTR)+7TQ hip.
4. TS hip.
5. TQ 5.D1
6. TP+TQ 5.H.2
7. TP+(R+TQ)VTR DC2,1
8. RVTR DC.7
9. TR MP8
```

f)  $\{((p \land q) \to r), (r \to s), (t \to \neg u), t, (\neg s \lor u)\} \models \neg (p \land q)$ 

```
F) { ((P n Q) -> R), (R -> S), (T -> TU), T, (TSUU) } + T(P n Q)

1. (P n Q) -> R

2. R -> S

3. (T -> TU)

4. T

5. TSU

1. P

6. U

5. TSU

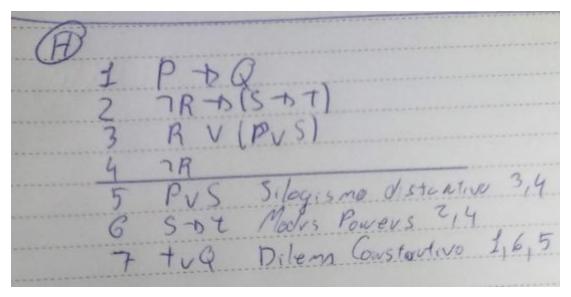
1. T

1.
```

#### g) $\{(p \rightarrow q), (q \rightarrow r), (s \rightarrow t), (p \lor s)\} \models (r \lor t)$

```
6) {(p+Q), (Q+R), (s-OT), (pvs)} + (RVT)
   1. P-0 Q
             mip .
   2. Q+R
   3. S.T
             mp.
            hip-
   5. R+S D.C. 2,4
             54.1,2
             Simp 3
             S.H. 6,7
   8 · P-PT
              5.6.5,6
             D.c. 8,9
             m P 10
             odição 11,7
```

h) 
$$\{(p \rightarrow q), (\neg r \rightarrow (s \rightarrow t)), (r \lor (p \lor s)), \neg r\} \models (q \lor t)$$



i) 
$$\{(p \rightarrow r), (q \rightarrow s), \neg r, (p \lor q) \land (r \lor s)\} \models s$$

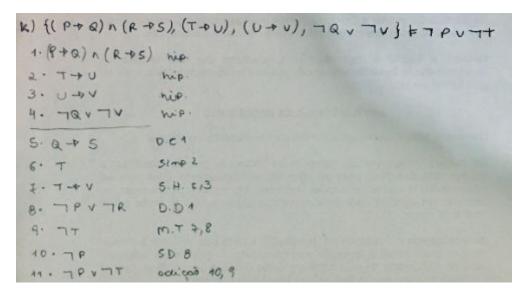
```
I) { (P+R), (Q+S), 7R, (PVQ) n (RVS) } $ $ $ 1. P+R & hwp. & hip. & hip.
```

 $j) \{(p \rightarrow q), (q \rightarrow r), (r \rightarrow s), \neg s, (p \lor t)\} \models t$ 

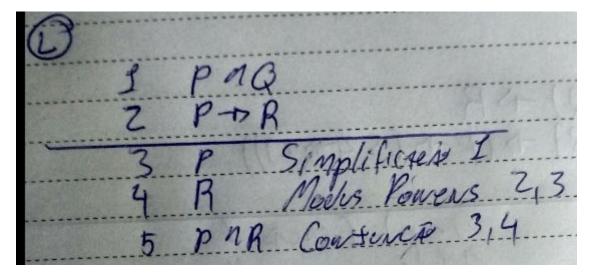
```
5) { (P + Q), (Q + R), (R + S), 75, (PVT)} FT

1. P+Q hep.
2. Q+R hip.
3. R+S hip.
4. 75 hip.
5. PVT hip.
6. P S.DA
7. T SDS
```

 $k) \left\{ \left( p \rightarrow q \right) \land \left( r \rightarrow s \right), \left( t \rightarrow u \right), \left( u \rightarrow v \right), \neg q \lor \neg v \right\} \vDash \neg p \lor \neg t$ 



l)  $\{(p \land q), (p \rightarrow r)\} \models (p \land r)$ 



#### $m) \left\{ \left( \neg p \land q \right), \left( r \rightarrow p \right) \right\} \vDash \left( \neg p \land \neg r \right)$

```
M) {(¬PNQ), (R→P)} F (¬PN¬R)

1. ¬PNQ mip.

2. R+P mip.

3. ¬R mT2

4. ¬P simp.1

5. ¬PN¬R conjunção 4,3
```

### n) $\{ (\neg p \rightarrow q), \neg (r \land s), (p \rightarrow (r \land s)) \} \models \neg p \land q$

### o) $\{(p \lor q), \neg r, (q \rightarrow r)\} \vDash p$

# $p) \left\{ \left( \, p \wedge q \, \right), \left( \, r \vee s \, \right), \left( \, p \rightarrow \neg s \, \right) \right\} \vDash r$

1	PNI	9		******		
2	RV	S			********	***********
3	Po	75			*********	
5	75	Simp				
6	R	P. 1	3 Pour			3 F
	-1-1	Siloy:	3.Me (	11314	1100	41.5

 $q) \{ p, (p \rightarrow \neg q), (q \lor r) \} \models p \land r$ 

r)  $\{\neg p, (p \lor (q \lor r)), \neg r\} \models q$ 

s) {  $p \lor \neg q$ ,  $\neg \neg q$ ,  $(p \rightarrow (r \land s))$  }  $\models s$ 

t)  $\{(p \rightarrow q), \neg q, (p \lor r)\} \models r$ 

$$u) \{ (p \lor \neg q), (r \rightarrow \neg p), r \} \vdash \neg q$$

1. PVTQ 2. R + TP 3. R	wip- nup- nup-		
4. PAR	541,3		
5. 70	MPA		

$$v)\;\{\,\neg\,p\;\vee\,\neg\,q\;,\neg\,\neg\,q\;,(\;r\;\rightarrow\;p\;)\;\}\vDash\neg\,r$$

$$w) \; \{ \; (\; p \; \rightarrow \; \neg \; q \; ) \; , \; \neg \; \neg \; q \; , \; (\; \neg p \; \rightarrow \; (\; r \; \forall \; s \; )) \; \} \vDash (\; r \; \forall \; s \; )$$

$$x)\;\{\,(\;p\wedge q\;)\,,(\;p\,\rightarrow\,r\;)\,,(\;r\wedge s\;)\,\rightarrow\,\neg\,t\,,(\;q\,\rightarrow\,s\;)\,\}\vDash\,\neg\,t$$

#### $y) \{ \neg p, (q \rightarrow p), ((\neg q \lor r) \rightarrow s) \} \models s$

```
y) {7P, (Q + P), ((7QVR) + S)} & S

1. 7P

2. Q+P

3. (7QVR) + S

H. 7Q+S

5. 7Q

MT2

pimplifipes 4
```

## $z) \left\{ \left( \left( p \land q \right) \rightarrow s \right), r, \left( r \rightarrow \left( p \land q \right) \right) \right\} \vDash \left( s \lor q \right)$

## aa) $\{(p \land \neg q), (r \to q), (r \lor s), (p \lor s) \to t\} \models t$

```
AA) { (PN 7Q), (R+Q), (RUS), (PVS) +T } FT
1 . PATQ
2. R+Q
             mip .
3. RVS
             hip .
             hip
4. PVS
5 . T
             hip
6. P-T
              54 9,5
7. Q
             5D 2
8. QVT
              polição 2,5
              MP 8
9. T
```

bb)  $\{(p \lor \neg q), (\neg q \to r), (p \to s), \neg r\} \models s$ 

```
2 PV R

2 79 + 10 R

3 P+ 10 S

4 7R

5 72Q Modes tollows 214

6 72QV7Q Modes tollows 214

7 2Q Silogistro distantivo 6

8 P Modes Powers 217

9 S Modes Powers 318
```

cc) 
$$\{(p \rightarrow q), (q \rightarrow \neg r), \neg \neg r, (p \lor (s \land t))\} \models s$$

```
1. P-PQ
2. (Q-P-TR) - Nip.
3. 7-TR Nip.
4. P v (S NT) Nip.
5. P + T SH4
6. Q + 7-TR SH2,3
7. P simp.5
8. S v P Dc 4,7
9. S simp.8
```

dd) 
$$\{(p \lor q), (q \to r), (p \to s), \neg s\} \models (r \land (p \lor q))$$

```
1. PVQ

2. Q + R

3. P + S

4. 75

5. 7 PVQ V 775 DD 1,4

6. Q + R V 75 DC 2,4

7. R

8. R N (PVQ) MT 2

0. R N (PVQ) cons. 7,1
```

```
ee) \{ (\neg p \lor \neg q), (\neg q \rightarrow \neg r), (\neg p \rightarrow t), \neg t \} \vDash \neg r \land \neg t
```

ff) 
$$\{(r \rightarrow t), (s \rightarrow q), (t \lor q) \rightarrow \neg p, (r \lor s)\} \models \neg p$$

```
1 R + t

2 S + D Q

3 (t v Q) + D 7 P

4 R v S

5 (t v Q) Dilem Constation 1, 2, 4

6 7 P Modes Powers 3, 15
```

gg) { ( p 
$$\rightarrow \neg$$
 q ) , (  $\neg$  q  $\rightarrow \neg$  s ) , (( p  $\rightarrow \neg$  s )  $\rightarrow \neg$  t ) , ( r  $\rightarrow$  t ) }  $\models \neg$  r

hh) 
$$\{((p \lor q) \to \neg r), (s \to p), (t \to q), (s \lor t)\} \models u \lor \neg r$$

```
HH) { ((PVQ) + TR), (S+P), (T+Q), (SVT)} $ + 0 V T R

1. (PVQ) + TR

2. (S+P)

3. T+Q

4. SVT

5. TS MT 4,2

6. P+TR SH1

7. TR Simplif. 6

8. UV TR odição 7
```