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Lab 2 – Translation to Propositional Logic and Alt-Ergo Verification Lab

Translation guide

Note : Replace • By /\

English	PL Translation
It is not the case that P.	~P
P and Q. P but Q. Although P, Q.	(P•Q)
P or Q. Either P or Q.	(P∨Q)
If P, then Q.	(P→Q)
P if Q.	(Q→P)
P only if Q.	(P→Q)
Only if P, Q.	(Q→P)
P if and only if Q. P just in case Q.	(P↔Q)
Neither P nor Q.	~(P∨Q)
It is not the case that both P and Q.	~(P•Q)
Both not P and not Q.	(~P•~Q)
P is necessary for Q.	(Q→P)
P is sufficient for Q.	(P→Q)
P is both necessary and sufficient for Q.	(P↔Q)
P unless Q.	(P∨Q) (~P→Q)

Translate the following sentences to propositional logic

1. "If Davide comes to the party, then Bruno and Carlo come too"
2. "Carlo comes to the party only if Angelo and Bruno do not come"
3. "Davide comes to the party if and only if Carlo comes and Angelo doesn't come"
4. "If Davide comes to the party, then, if Carlo doesn't come then Angelo comes"
5. "Carlo comes to the party provided that Davide doesn't come, but, if Davide comes, then Bruno doesn't come"
6. "A necessary condition for Angelo coming to the party, is that, if Bruno and Carlo aren't coming, Davide comes"
7. "Angelo, Bruno and Carlo come to the party if and only if Davide doesn't come, but, if neither Angelo nor Bruno come, then Davide comes only if Carlo comes"
8. If you play and you study, you'll pass the exams, while if you play and don't study you won't pass. Thus, if you play, either you study and you'll pass the exams, or you don't study, and you won't pass.
9. If it rains while the sun shines, a rainbow will appear
10. Charles comes if Elsa does and the other way around
11. Johan comes just when Peter stays at home

12. We are going, unless it is raining
13. Charles and Elsa are brother and sister or nephew and niece
14. If I have lost if I cannot make a move, then I have lost.
15. If Paola is happy and paints a picture then Renzo isn't happy
16. If Paola is happy, then she paints a picture
17. Paola is happy only if she paints a picture

Apply the inference rules and verify the validity of the following sequents. Also check the validity using Alt-Ergo

1. (p /\ q) /\ r , s /\ t |-- (q /\ s)

Sample Solution:

(1) (p /\ q /\ r) premise
(2) (s /\ t) premise
(3) (p /\ q) /\e 1 (/\ elimination)
(4) q /\e 3 (/\ elimination)
(5) s /\e 2 (/\ elimination)
(6) (q /\ s) /\i 4,5 (/\ introduction)

2. (p /\ q /\ r) |-- p /\ (q /\ r)
3. q --> (p --> r), not r, q |-- not p
4. p |-- (p --> q) -> q
5. q --> r |-- (p --> q) -> (p --> r)
6. p --> q, r --> s |-- p \/ r --> q \/ s