Question 1 Use the tableau algorithm to test the satisfiability of $\exists S.C \sqcap \forall S.(\neg C \sqcup \neg D) \sqcap \exists R.C$ (Hint: to test the satisfiability of a concept X, you have to show that it is possible for some element y to be member of X, in other words you have to use a tableau to construct a model for y:X).

Answer 1 We try to construct a model:

1	$y : \exists S.C \sqcap \forall S.(\neg C \sqcup \neg D) \sqcap \exists R.C$	$\mathcal{A}$
2	$y : \exists S.C$	$(\sqcap : 1)$
3	$y : \forall S.(\neg C \sqcup \neg D)$	$(\sqcap : 1)$
4	$y : \exists R.C$	$(\sqcap : 1)$
5	$(y, p) : S$	$(\exists : 2)$
6	$p : C$	$(\exists : 2)$
7	$(y, q) : R$	$(\exists : 4)$
8	$q : C$	$(\exists : 4)$
9	$p : \neg C \sqcup \neg D$	$(\forall : 3, 5)$
10^{split_1}	$p : \neg C$	$(\sqcup : 9)$
11^{split_1}	clash	$(6, 10^1)$
10^{split_2}	$p : \neg D$	$(\sqcup : 9)$

A model exists that demonstrates the satisfiability.

Question 2 Given the following interpretation of the concepts

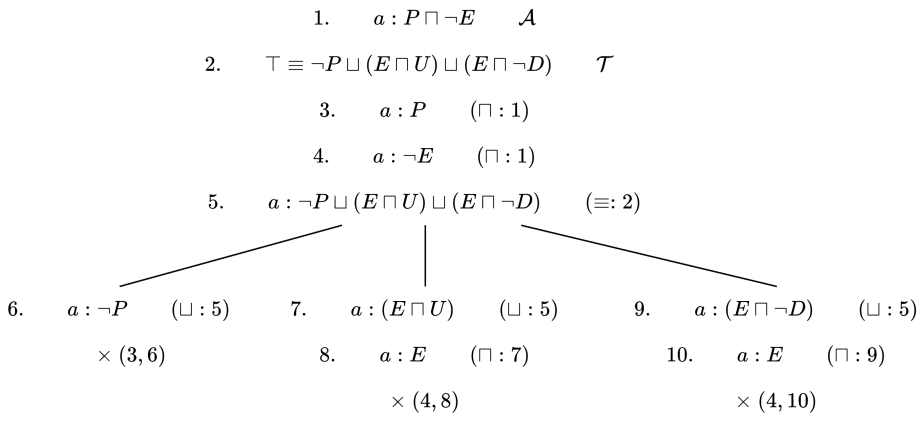
- Person = {Daisy, Dan, Dirk, Pat, Paul}
- Doctor = {Daisy, Dan, Dirk}
- Patient = {Pat, Paul, Dan}
- Treats = {(Daisy, Pat), (Dan, Paul), (Dirk, Dan), (Dan, Dan)}
- Suffers_from ={(Pat, pain), (Paul, pain), (Dan, pain), (Dan, sickness)}

Compute the interpretation of the following expressions:
a) Doctor ⊓ Patient
b) Person ⊓ ∃treats.Doctor

Answer 2
a) $(\text{Doctor} \sqcap \text{Patient})^{\mathcal{I}} = \{\text{Dan}\}$
b) $(\text{Person} \sqcap \exists \text{treats.Doctor})^{\mathcal{I}} = \{\text{Dirk}, \text{Dan}\}$

Question 3 Show that from the knowledge base: $P \sqsubseteq (E \sqcap U) \sqcup (E \sqcap \neg D)$
we can derive that $P \sqsubseteq E$

Answer 3 we have to show that $a : P \sqcap \neg E$ is not satisfiable given that the TBox is not empty.



Yes, given the TBox, P is subsumed by E.