CS 188 HW 188

1) a) i) $\alpha_1 = A \vee B$: $\frac{3}{4}$ or $\frac{12}{16}$ so 12 models out of 16

ii) $\alpha_2 = (A \wedge B) \Rightarrow C$: $\frac{7}{8}$ or $\frac{14}{16}$ so 14 models out of 16

iii) $\alpha_3 = (A \wedge B) \vee (\neg C \vee D)$: $\frac{13}{16}$ so 13 models out of 16

A	B	C	D	α_3
T	T	T	T	T
T	T	T	F	T
T	T	F	T	T
T	T	F	F	T
T	F	T	T	T
T	F	T	F	F
T	F	F	T	T
T	F	F	F	T
F	T	T	T	T
F	T	T	F	F
F	T	F	T	T
F	T	F	F	T
F	F	T	T	T
F	F	T	F	F
F	F	F	T	T
F	F	F	F	T

b) i) A doesn't want to sit next to B.

$\neg(X_{A,L} \wedge X_{B,M}) \wedge \neg(X_{A,M} \wedge X_{B,L}) \wedge \neg(X_{A,M} \wedge X_{B,R})$
$\wedge \neg(X_{A,R}, X_{B,M})$

ii) A doesn't want to sit in the left chair

$\neg X_{A,L}$

iii) C doesn't want to sit to the (adjacent) right of B.

$$\neg(X_{C,M} \land X_{B,L}) \land \neg(X_{C,R} \land X_{B,M})$$

iv) Yes, we have to specify that no 2 person can sit at the same chair. (This is going be long :( )

$$\neg(X_{A,L} \land (X_{B,L} \lor X_{C,L})) \land \neg(X_{A,M} \land (X_{B,M} \lor X_{C,M}))$$
$$\land \neg(X_{A,R} \land (X_{B,R} \lor X_{C,R})) \land \neg(X_{B,L} \land (X_{A,L} \lor X_{C,L}))$$
$$\land \neg(X_{B,M} \land (X_{A,M} \lor X_{C,M})) \land \neg(X_{B,R} \land (X_{A,R} \lor X_{C,R}))$$
$$\land \neg(X_{C,L} \land (X_{A,L} \lor X_{B,L})) \land \neg(X_{C,M} \land (X_{A,M} \lor X_{B,M}))$$
$$\land \neg(X_{C,R} \land (X_{A,R} \lor X_{B,R}))$$

5) No, not satisfiable since parts i and ii $\Rightarrow X_{A,R} \land X_{B,L}$

only spot left for C is middle which violates iii thus not satisfiable

c) i) Initially inferred is all false, count set to # of premises for each clause and agenda empty, which will have A at the beginning

0th Iteration Inferred:

A	B	C	D
F	F	F	F

Agenda: [A] Count

A	B	C	D
0	1	1	2

Pops A and does the appropriate actions to get to

1st Iteration Inferred:

A	B	C	D
T	F	F	F

Agenda: [B, C] Count

A	B	C	D
0	0	0	2

Pops B and does the appropriate actions to get to

2nd Iteration Inferred

A	B	C	D
T	T	F	F

Agenda: [C] Count

A	B	C	D
0	0	0	1

Continues on the next page (sorry)

3rd iteration

Pops C and does the appropriate actions to get to

Inferred

A	B	C	D
T	T	T	F

Agenda: [D]

Count

A	B	C	D
0	0	0	0

4th Iteration

Pops D and does the appropriate actions to get to

Inferred

A	B	C	D
T	T	T	T

Agenda: [ ]

Count

A	B	C	D
0	0	0	0

ii) Simply call DPLL(KB.clauses, KB.symbols, $True \Rightarrow D$) or in other words use SAT solver to check if $True \Rightarrow D$ is satisfiable in KB

iii) In CNF the clauses may be represented as:

$$(A) \land (\neg A \lor B) \land (\neg A \lor C) \land (\neg B \lor \neg C \lor D)$$

$\land (\text{False} \lor D)$ last clause comes from $True \Rightarrow D$ or $\models_{KB} D$

Simplifies to just D

iv) We begin with the set of clauses from part iii; since none of the base cases are satisfied we look at pure-symbols/literals

Since A is pure set A = True the simplified remaining clauses are

$$(\text{False} \lor B) \land (\text{False} \lor C) \land (\neg B \lor \neg C \lor D) \land (\text{False} \lor D)$$

We continue with unit-clauses which simplifies clauses to

$(B) \land (C) \land (\neg B \lor \neg C \lor D) \land (D)$ then assign values to pure literals to get B = True C = True D = True to simplify:

$(\text{False} \lor \text{False} \lor \text{True})$ which hits the base case of all statements being True thus returns true as satisfiable for $KB \models D$