Section 1

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Let us define equi-satisfiable relation over the set of wffs as follows. A and B are equi-satisfiable iff (A is satisfiable iff B is satisfiable). Which of the following formulas are true?

- [x] Equi-satisfiable is a reflexive relation
- [x] Equi-satisfiable is a symmetric relation
- [x] Equi-satisfiable is a transitive relation
- [x] Equi-satisfiable is an equivalence relation
- [ ] None of these

Which of the following statements are true?

- [x] Every atomic proposition is a literal
- [ ] Every formula is a literal
- [ ] Every literal is an atomic proposition
- [ ] None of these
- [x] Every literal is a formula

Which of the following statements are true? "\cup" denotes set union and "\" denotes set minus.

- [x] If U |= A then U \cup {B} |= A for any B
- [x] If U|=A then U\cup {B}|= A for any valid formula B
- [ ] If U|=A then U\{B}|= A for any B
- [ ] If U|=A then U\{B}|= A for any valid B

Let us define a set of good formulas inductively.

- Every atomic proposition p is a good formula.
- If A is a good formula, then $(\sim A)$ is a good formula.
- If A and B are good formulas then $(A/\backslash B)$ is a good formula.

Consider a semantic tableaux T of a good formula. Recall U(n) denotes the set of formulas associated with the node n in T.

For which of the following measures, $W(n) < W(n_1)$ where n is child of n_1?

- [x] W(n)= number of operators in U(n).
- [ ] W(n)= number of conjunct operators (/\) in U(n)
- [x] W(n)=number of unary operators in U(n) + 2 *number of conjunct operators in U(n)
- [x] W(n)= number of conjunct operators in U(n)+2* number of unary operators in U(n)
- [ ] None of these

Which of the following statements are true about box clause?

- [ ] Box clause is valid
- [x] Box clause is unsatisfiable
- [x] Box clause is a clause without any literals
- [x] Any clause set contacting box clause is unsatisfiable
- [ ] None of these

Consider the following logic program P= {likes(john,flowers). likes(mary,food). likes(mary,oj). likes(john,oj). likes(john,mary). likes(paul,mary).}. What Prolog will return for the query likes(mary,X)?

- [ ] None of these
- [ ] X
- [x] oj
- [ ] Paul
- [ ] John

Let us define a set of good formulas inductively. Two fixed atomic proposition p and q are good formulas. If A and B are good formulas then (A<->B) is a good formula and (A /\B) is a good formula. Which of the following statements are true?

- [ ] Every good formula is valid or equivalent to (p/\q)
- [ ] There are no good formulas which are valid.
- [ ] Every good formula is equivalent to p or q or (p->q)
- [x] None of these
- [ ] Every good formula is equivalent to either p or q

Let C1={p,~q,~r}, C2={p,q,~r} be two clauses. Which of the following statements are true?

- [x] {p,~r} is a resolvent of C1 and C2
- [ ] {p,r,~r} is a resolvent of C1 and C2
- [ ] {p} is a resolvent of C1 and C2
- [ ] {p,q,~q) is a resolvent of C1 and C2
- [ ] None of these

Which of the following statements are true? Recall, we will use set notation for CNF formulas only.

- [ ] {{p,q,r}} is a horn formula
- [x] {{p,~q,~r},{~q,~r}} is a horn formula
- [x] {{p},{q},{r}} is a horn formula
- [x] {{~q,~r}{~p,~r}} is a horn formula
- [ ] None of these

Let us define equi-satisfiable relation over the set of wffs as follows. A and B are equi-satisfiable iff (A is satisfiable iff B is satisfiable). Which of the following statements are true?

- [ ] If A and B are equi-satisfiable then A is satisfiable
- [x] If A and B are valid then A and B are equi-satisfiable
- [x] If A and B are satisfiable then A and B are equi-satisfiable
- [x] Atomic propositions p and q are equi-satisfiable.
- [ ] None of these

Consider the formula (p\/~q) /\ (p/\~q).

- [ ] None of these
- [ ] All the semantic tableaux of the above formula are closed
- [ ] There exists an unique semantic tableaux for the above formula
- [ ] Any semantic tableaux of the above formula will have at least 6 nodes
- [x] All the semantic tableaux of the above formula are open

Which of the following is true about bi-implication operator in a semantic tableau?

- [ ] None of these
- [x] (A<-> B) is an alpha-formula with alpha1=(A->B), alpha2=(B ->A)
- [ ] (A<-> B) is an alpha-formula with alpha1=A, alpha2=B
- [x] ~(A<-> B) is a beta-formula with beta1=(~A)/\B, beta2=A/\(~B)
- [ ] (A<->B) is a beta formula with beta1=A, beta2=B

Let S be a set of clauses. Each clause in S has at most three literals. Number of clauses in S is k and the number of atomic propositions used in S is at most n. Which of the following statements are true?

- [ ] None of these
- [x] Number of clauses in Res*(S) is at most n^3+n
- [x] Number of clauses in Res*(S) is at least k
- [ ] Each clause in Res*(S) has at most four literals
- [ ] Number of clauses in Res*(S) is at most k^3+k

Which of the following restrictions of propositional logic formulas lead to polynomial running time algorithm for the satisfiability problem?

- [ ] Restricting to DNF formulas
- [ ] Restricting to CNF formulas
- [x] Restricting to Horn formulas
- [x] Restricting to CNF formulas in which if a literal occurs in the formula then its complementary pair will not occur in the formul

Which of the following statements are true about Semantic tableau method?

- [x] It is a syntactic method
- [ ] It is an efficient method
- [ ] To apply this method, formula should be in DNF
- [ ] None of these
- [ ] To apply this method, formula should be in CNF

Which of the following statements are true about Resolution?

- [ ] Resolution is an efficient method
- [x] To apply resolution method, formula should be in CNF
- [ ] To apply resolution method, formula should be in DNF
- [ ] None of these
- [x] Resolution is a syntactic method

Let us define equi-satisfiable relation over the set of wffs as follows. A and B are equi-satisfiable iff (A is satisfiable iff B is satisfiable). Which of the following statements are true?

- [ ] If A and B are equi-satisfiable, then A and B are valid
- [ ] If A and B are equi-satisfiable, then A and B are satisfiable
- [x] Atomic propositions p and ~p are equi-satisfiable.
- [ ] (p->~p) and (p/\~p) are equi-satisfiable
- [ ] None of these

Which of the following statements are true? Formulas are represented using clause set notation. Here \box denotes the box clause.

- [ ] {\box} is equivalent to the empty clause set {}
- [x] {{p}, \box} is equi-satisfiable to {\box}
- [ ] {{p}, \box} is equi-satisfiable to {p}
- [ ] None of these
- [ ] {{p}, \box} is equivalent to the empty clause set {}

Which of the following statements are true about Res operator? Recall that for a given set of clauses S, Res(S)=S \cup {R: R is a resolvent of two clauses in S} and \box denotes the box clause.

- [ ] For all set of clauses S, Res*(S)=Res(S)
- [ ] For all set of clauses S, Res(S)=S
- [x] For all set of clauses S, Res(S) is equivalent to S
- [x] If S is unsatisfiable, then Res(S)={\box}
- [ ] None of these

Which of the statements are true about the following algorithm for validity problem.

Algorithm simple-validity(A)

If A is an atomic. proposition then return Yes

else return No

- [ ] Algorithm simple-validity is sound for validity problem
- [ ] None of these
- [ ] Algorithm simple-validity is complete for validity problem
- [x] Algorithm simple-validity is neither complete nor sound for validity problem
- [x] Algorithm simple-validity terminates on all inputs

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