1. a) Define the concept of critical pair of two rewrite rules. (2)

b) Explain the significance of critical pairs in the use of rewrite rules. (8)

c) Form all critical pairs for the following set of rewrite rules.

$$e \circ X \Rightarrow X$$
$$Y \circ f \Rightarrow Y$$

(8)

d) What further rewrite rules might be added to this set as a result of the critical pairs identified in part (c)? (2)

2. a) Define the full resolution rule of inference for clauses in Kowalski format. (2)

b) Describe the LUSH Resolution and SL Resolution restrictions on full resolution. (8)

c) Give an SL Resolution refutation of following clauses:

1. -> sunny(Day) v rainy(Day)
2. sunny(Day) -> picnic(Day)
3. rainy(Day) -> picnic(next(Day))
4. picnic(Day) ->

(7)

d) Explain why it is not possible to give a LUSH Resolution refutation of these clauses. (3)

3. a) What is an interpretation of a set of predicate calculus sentences? (2)

b) How can interpretations be used to control the search for a proof of a conjecture? (8)

3. c) Draw the LUSH Resolution search space for clauses 1-6 below, with clause 6 as top clause.

1. $p(X)^{\&}\ q(X) \rightarrow r(X)$
2. $s(X) \rightarrow r(X)$
3. $t(X) \rightarrow s(X)$
4. $\rightarrow p(a)$
5. $\rightarrow q(a)$
6. $r(a) \rightarrow$ (3)

d) Give an interpretation which could be used to control this search, and explain what its effect would be on the search space. (7)

a) Define the full resolution rule of inference for clauses in Kowalski form.

b) Describe the LUSH Resolution and SL Resolution restrictions on full resolution.

c) Give an SL Resolution refutation of the following clauses:

i) -> odd(N) v even(N)

ii) even(K) -> odd(s(K))

iii) odd(M) -> even(s(M))

iv) odd(X) ->

Take iv as the top clause.

d) Explain why it is not possible to give a LUSH Resolution refutation of these clauses.

a) What is an interpretation of a set of predicate calculus sentences?

b) How can interpretation be used to control the search for a proof of a conjecture?

c) Draw the LUSH Resolution search space for the clauses below, with viii as the top clause, to depth 4.

i) q(X) -> z(X)

ii) r(s(Y)) -> q(Y)

iii) q(s(Z)) -> r(Z)

iv) t(W)&m(s(W)) -> z(W)

v) -> t(a)

vi) m(V) -> m(s(V))

vii) -> m(a)

viii) z(a) ->

d) Give an interpretation which could be used to control this search, and explain what its effect would be on the search space.

Hint: Try the predicate "zero-or-odd" as an assignment for z.