



Family Name :

FirstName :

*LKR – SD206*

## *Logic & Knowledge Representation*

Jean-Louis Dessalles

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Duration: 70 minutes. No documents - No turned-on devices. Questions are independent.

Please answer in English. Be concise and relevant. Please use beautiful (i.e. readable) handwriting.

Q1. A directed graph is stored using the predicate  $\text{edge}(X, Y)$ , which indicates that there is a one-way link between node  $X$  and node  $Y$ .

Write a predicate `cycle` that checks whether there are cycles in the graph.

Q2. Consider the small DCG grammar:

```
aff --> np, vp.  
np --> [they]; [she].  
np --> det, n.  
vp --> v, np.  
v --> [like].  
det --> [the].  
n --> [cake].
```

This grammar recognizes affirmative sentences such as "they like the cake".

Write a DCG program that recognizes interrogative sentences in English.

It should recognize sentences like (we only consider 3rd person):

"do they like the cake", "are they crazy", and even the incorrect sentence "is they crazy", but not "do they crazy".

Then propose a way to discard "is they crazy".

Q3. Show using resolution method that:

$((a \supset b) \supset (\neg(b \vee (c \wedge d)) \supset \neg(a \vee (c \wedge d)))$  is a true formula.

Q4. Prove that  $\{(\forall x) (P(x) \vee Q(x)), (\exists x) \neg P(x)\} \vdash (\exists x) Q(x)$ .

Q5. The sequence aabbcc... can be continued in countless ways. Indicate two "natural" continuations. For each of them, provide a theoretical reason for why it is "natural".