AI Foundations & Applications (AI61005)
Class Test 3
November 1, 2021

Question Paper has THREE Parts. This is PART C – Third Part

Time 25 Minutes

Answer All Questions

Write your name and roll number on every sheet.

Try to use one page to answer one full question – total of 2 pages only for this part

Combine the sheets into a single pdf (Max 10MB) and upload using the Google Form provided.

1. There are four characters in a play: Sherlock, Watson, Moriarty and Lestrade. **You want to accommodate at least three of them in the same compartment.** If Watson is accommodated in a compartment, so should be Sherlock in the same compartment. But Sherlock and Moriarty cannot be accommodated in the same compartment (Otherwise, may lead to The Reichenbach Fall 😊). Is it possible to accommodate at least three of them in the same compartment? Solve this with Satisfiability solver.
    a. Write the propositional formula to represent the constraints/facts above.
    b. Convert the propositions into their corresponding CNF. Hint: 'accommodate at least three of them in the same compartment' has to be written differently than the natural propositional representation to do the CNF conversion easily.
    c. Find a satisfying assignment (if any) using DPLL solver. Show the steps.

    [2+2+3= 7]

2. Let us consider the following clauses in a given knowledge base Δ.

$$C1: (x_1, x_2)$$
$$C2: (x_1, x_3, x_7)$$
$$C3: (\neg x_2, \neg x_3, x_4)$$
$$C4: (\neg x_4, x_5, x_8)$$
$$C5: (\neg x_4, x_6, x_9)$$
$$C6: (\neg x_5, \neg x_6)$$

While solving satisfiability, let us consider that the following partial assignments have been performed

$$\{x_7 = f/1,\ x_8 = f/2, x_9 = f/3\}$$

The current level is 4 and decision is being made of the form $\{x_1 = f/4\}$. The convention $\{X = t/d\}$ should be read as standard implication graph node convention (i.e. X proposition is assigned value 'True' at level 'd').

    a. Draw the *complete implication graph* starting from the given partial assignment and the decision at the current level
    b. Derive *four conflict driven clauses* from the implication graph.

    [4+4=8]