



EVALUASI AKHIR SEMESTER (EAS) TEKNIK INFORMATIKA, FT-EIC
INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) SURABAYA, 2020 – 2021

Course : KI141315 Artificial Intelligence /3 credits (**Open Book, Calculator**)
Instructors : Nanik Suciati, Chastine Fatichah, Dini A. Navastara, Shintami C. Hidayati
Materials : *Constraint Satisfaction Problem, First Order Logic, Bayesian learning*
Time : Monday, July 5, 2021 (13.00-15.00)

1. Complete the **Crossword puzzle** below using *Constraint Satisfaction Problem* (CSP).

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | | 2 | | 3 |
| 2 | # | # | | # | |
| 3 | # | 4 | | 5 | |
| 4 | 6 | # | 7 | | |
| 5 | 8 | | | | |
| 6 | | # | # | | # |

Given the list of words:

| | |
|-------|-------|
| AFT | LASER |
| ALE | LEE |
| EEL | LINE |
| HEEL | SAILS |
| HIKE | SHEET |
| HOSES | STEER |
| KEEL | TIE |
| KNOT | |

Number 1, 2, 3, 4, 5, 6, 7 in the Crossword puzzle correspond to the words that will start at those locations

Please answer the questions based on the crossword puzzle problem:

- Mention the Variable, Domain, and Constraint
- Draw the graph
- Solve the **Crossword puzzle** using Forward Checking and Backtracking algorithm, if the word at **1Across** is "HOSES".



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2-1. Which of the following English sentences are propositions?

(Hint: A proposition is either True or False but cannot be both.)

- a. Everyone is happy.
- b. $x + 3$ is positive or negative.
- c. Let's go to shopping!
- d. What a delicious food!
- e. I take a bus to New York.

2-2. Convert the following sentence into first-order predicate calculus logic:

- a. There is a baseball player who has played in every game this season.
- b. Not all students like both Discrete Mathematics and Calculus.
- c. Coco is the only yellow poodle.



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3. Given the list of Predicates:

| | | |
|---------------------|-----|-------------|
| food(x) | --- | x is food |
| likes(x,y) | --- | x likes y |
| eats(x,y) | --- | x eats y |
| alive(x) | --- | x is alive |
| killed(x) | --- | x is killed |
| Andi, Budi and Cika | --- | individual |

a. Change the sentences to First-Order-Logic (FOL) using the list of Predicates.

| #S | Sentences | FOL |
|----|---|-----|
| 1 | Budi likes all kind of food | |
| 2 | Anything anyone eats and not killed is food | |
| 3 | Andi eats peanuts and still alive | |
| 4 | Cika eats everything that Anil eats | |
| 5 | All who live if and only if not killed | |

b. Change the expressions on (a) to clauses of Conjunctive Normal Form (CNF).
Each clause at the #C column is the derivation of sentence at the #S column.

| #C | #S | Clauses of CNF |
|----|----|----------------|
| 1 | 1 | |
| 2 | 2 | |
| 3 | 3 | |
| 4 | 3 | |
| 5 | 5 | |
| 6 | 6 | |
| 7 | 6 | |

c. Using the set of clauses on (b), prove that **Budi likes peanuts** using the Resolution algorithm.



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4. Various kinds of mushrooms grow on an island. Some types of mushrooms are poisonous so they can't be eaten, but some are edible. The following table provides data on several types of mushrooms. It is known whether the 1st to 8th mushrooms can be eaten or not. However, it is not known for certain about the 9th, 10th and 11th mushrooms.

| Mushroom | Not heavy | Stench | Spotted | Smooth | Can Eat |
|----------|-----------|--------|---------|--------|---------|
| 1 | 1 | 0 | 0 | 0 | 1 |
| 2 | 1 | 0 | 0 | 1 | 1 |
| 3 | 0 | 1 | 1 | 0 | 1 |
| 4 | 0 | 0 | 1 | 0 | 0 |
| 5 | 1 | 1 | 0 | 1 | 0 |
| 6 | 1 | 0 | 1 | 1 | 0 |
| 7 | 1 | 0 | 1 | 0 | 0 |
| 8 | 0 | 1 | 0 | 0 | 0 |
| 9 | 0 | 1 | 1 | 1 | ? |
| 10 | 1 | 0 | 1 | 0 | ? |
| 11 | 1 | 0 | 0 | 0 | ? |

Write the probabilities of the classes “Edible”=0 and “Edible”=1 and determine the class label “Edible” using Naïve Bayes for:

- Mushroom #9
- Mushroom #10
- Mushroom #11