**Prompt #1 (Introduction)**

Hello, can you please solve some problems either directly, or if that is not possible then indirectly by providing source code for solving them?

**Prompt #2 (Problem #1)**

Can you solve the following:

x1,x2,x3,x4,x5,x6,x7 are Boolean. Is the following formula satisfiable? /\ stand for AND and \/ for OR:

/\ (x1 \/ x2 \/ x5 \/ x4)

/\ (x1 \/ x2 \/ ~x5 \/ x4)

/\ (x3 \/ x6)

/\ (~x4 \/ x7 \/ x1)

/\ (~x4 \/ ~x7 \/ x2)

**Prompt #3 (Problem #2)**

Next problem, can you solve the following:

Knights: always tell the truth

Knaves: always lie

1: A says: “B is a knave or C is a knave”

2: B says “A is a knight”

What are A & B & C?

**Prompt #4 (Problem #3)**

Next problem, can you solve the following:

A) Having one 3 gallon and one 5 gallon jug, we need to measure precisely 4 gallons.

B) Having one 3 gallon and one 9 gallon jug, we need to measure precisely 7 gallons.

**Prompt #5 (Problem #4)**

Next problem, can you solve the following:

Find a different digit (between 0 and 9) for each capital letter in the following equation:

K I S S \* K I S S = P A S S I O N

**Prompt #6 (Problem #5)**

Next problem, can you solve the following:

Someone in Dreadsbury Mansion killed Aunt Agatha. Agatha, the butler, and Charles live in Dreadsbury Mansion, and are the only ones to live there. A killer always hates, and is no richer than his victim. Charles hates noone that Agatha hates. Agatha hates everybody except the butler. The butler hates everyone not richer than Aunt Agatha. The butler hates everyone whom Agatha hates. Noone hates everyone. Who killed Agatha?

**Prompt #7 (Problem #6)**

Next problem, can you solve the following:

A bank van had several bags of coins, each containing either 16, 17, 23, 24, 39, or 40 coins. While the van was parked on the street, thieves stole some bags. A total of 100 coins were lost. It is required to find how many bags were stolen. You may assume, if needed, that there are multiple bags for each number of coins.

**Prompt #8 (Problem #7)**

Next problem, can you solve the following:

Assign the numbers 1..8 to vertices A..H in the undirected graph below such that the values of connected vertices differ by more than one. Graph links are: (A,B), (A,C), (A,D), (A,E), (B,D), (B,E), (BF), (C,D), (C,G), (D,E), (D,G), (D,H), (E,G), (E,H), (E,F), (F,H), (G,H).

**Prompt #9 (Problem #8)**

Next problem, can you solve the following:

Can you place two queens and seven knights on a 6x6 chess board?

**Prompt #10 (Problem #9)**

Next problem, can you solve the following:

The following program is an example of an asynchronous model. It uses a variable semaphore to implement mutual exclusion between two asynchronous processes. Each process has four states: idle, entering, critical and exiting. The entering state indicates that the process wants to enter its critical region. If the variable semaphore is FALSE, it goes to the critical state, and sets semaphore to TRUE. On exiting its critical region, the process sets semaphore to FALSE again.

MODULE main

VAR

semaphore : boolean;

proc1 : process user(semaphore);

proc2 : process user(semaphore);

ASSIGN

init(semaphore) := FALSE;

MODULE user(semaphore)

VAR

state : idle, entering, critical, exiting;

ASSIGN

init(state) := idle;

next(state) :=

case

state = idle : idle, entering;

state = entering & !semaphore : critical;

state = critical : critical, exiting;

state = exiting : idle;

TRUE : state;

esac;

next(semaphore) :=

case

state = entering : TRUE;

state = exiting : FALSE;

TRUE : semaphore;

esac;

FAIRNESS

Running

A desired property for this program is that it should never be the case that the two processes proc1 and proc2 are at the same time in the critical state (this is an example of a “safety” property).

A) Can you check if the property holds?

B) Can you express the property in CTL temporal logic?

Another desired property is that, if proc1 wants to enter its critical state, it eventually does (this is an example of a “liveness” property).

C) Can you check if the property holds?

D) Can you express the property in CTL temporal logic?

**Prompt #11 (Problem #10)**

Next problem, can you solve the following:

Repeat for the same program as before but using LTL for checking the following properties:

A) Can you express the specification that the two processes cannot be in the critical region at the same time using LTL temporal logic and check if the property holds?

B) Can you express that whenever a process wants to enter its critical session, it eventually does using LTL and check if the property holds.

**Prompt #12 (Problem #11)**

Next problem, can you solve the following:

We try to place as many bishops as possible on a 8 by 8 chess board. Can you find the maximum number of bishops and their positions on the chess board?

**Prompt #13 (Problem #12)**

Next problem, can you solve the following:

We have the following information:

1. There are three boxes, one contains only pencils, one contains only pens, and one contains both pencils and pens.

2. The boxes have been incorrectly labeled such that no label identifies the actual contents of the box it labels.

3. Opening just one box, and without looking in the box, you take out one object.

By looking at the object, how can you immediately label all of the boxes correctly?

**Prompt #14 (Problem #13)**

Next problem, can you solve the following:

There is a table with room for three boxes. There are three boxes, a Red, a Green and a Blue box. The Red box is on the table. The Blue box is on the Red and the Green box is on the table.

A) Can you move boxes one by one so as to have the Red box on the Green, the Green on Blue, and the Blue one on the table?

B) Can you also solve the same problem when there is room for two boxes on the table?

**Prompt #15 (Problem #14) (source: https://www.geeksforgeeks.org/sudoku-backtracking-7/)**

Next problem, given the following Sudoku grid can you provide a solution?

Grid:

{ {3, 0, 6, 5, 0, 8, 4, 0, 0},

{5, 2, 0, 0, 0, 0, 0, 0, 0},

{0, 8, 7, 0, 0, 0, 0, 3, 1},

{0, 0, 3, 0, 1, 0, 0, 8, 0},

{9, 0, 0, 8, 6, 3, 0, 0, 5},

{0, 5, 0, 0, 9, 0, 6, 0, 0},

{1, 3, 0, 0, 0, 0, 2, 5, 0},

{0, 0, 0, 0, 0, 0, 0, 7, 4},

{0, 0, 5, 2, 0, 6, 3, 0, 0} }

**Prompt #16 (Problem #15) (source: https://prob.hhu.de/w/index.php?title=The\_Jobs\_Puzzle)**

Final problem, can you solve the following:

There are four people: Roberta, Thelma, Steve, and Pete.

Among them, they hold eight different jobs.

Each holds exactly two jobs.

The jobs are: chef, guard, nurse, clerk, police officer (gender not implied), teacher, actor, and boxer.

The job of nurse is held by a male.

The husband of the chef is the clerk.

Roberta is not a boxer.

Pete has no education past the ninth grade.

Roberta, the chef, and the police officer went golfing together.

Who holds which job?