**Solve the Puzzles below:**

1. **A Locked Door**

You have 100 bags of coins each with 100 coins, but only one of these bags has gold coins. You have to identify this bag to leave the room. The gold coin weighs 1.01 ounce and the other coins weighs 1 ounce. You also have a scale but can only use it once. How can you identify the bag of gold coins?

**Solution**:

(1) Take one coin from bag 1, two coins from bag 2, ..., 100 coins from bag 100. Put all of these on the scale and weigh them.

(2) If the gold coins are in bag 1, the scale will register 5050.01. If the gold coins are in bag 2, the scale will register 5050.02. If the gold coins are in bag 17, the scale will register 5050.17 ………………..

1. **Brown Eyes and Red Eyes**

There is a monastery of silent monks with no mirrors and one important rule: no red eyes! If a monk discovers he has red eyes he must leave that night. All is well until a visitor says "at least one of you has red eyes!". What happens next?

**Solution**:

[1] If there is only one Red Eye monk, this monk will look every one and finds that everyone has brown eyes, which implies that he has the red eyes. So, he will leave the room on the first night.

[2] If there are 2 red eyed monks, the first one will think – I see a monk with red eye and the remaining once with brown eyes. If he is the only red eyed guy, he must left the room, since he did not leave, there must be another red eyed guy, but I can see only one red eyed guy, that implies I am a red eyed guy. The second monk thinks the same way. So, both on them will leave the room on the second night.

[3] Similarly, if there are 3 monks, all the 3 monks will leave the room on the 3rd night

1. **Unusual Suspects**

The police rounded up Jim, Bud and Sam yesterday, because one of them was suspected of having robbed a bank. The three suspects made the following statements under intensive questioning: Jim: I’m innocent. Bud: I’m innocent. Sam: Bud is guilty. If only one of these statements is true, who robbed the bank?

**Solution**:

J – Jim says the true, B – Bud says the true, S- Sam says the true,

JI– Jim is innocent, BI – Bud is innocent, SI – Sam is innocent

J -> JI, B -> BI, S -> ¬BI.

J v B v S,

J -> (¬B ^ ¬S), B -> (¬J ^ ¬S), S -> (¬J ^ ¬B).

¬J v (¬B ^ ¬S), ¬ B v (¬J ^ ¬S), ¬S v (¬J ^ ¬B)

¬J v ¬B, ¬J v ¬S, ¬B v ¬S.

We have:

K |- α iff K∪{α} |- NIL

{¬J v JI, ¬B v BI, ¬S v ¬BI, J v B v S, ¬J v ¬B, ¬J v ¬S, ¬B v ¬S } |- ¬BI

which means

{¬J v JI, ¬B v BI, ¬S v ¬BI, J v B v S, ¬J v ¬B, ¬J v ¬S, ¬B v ¬S, BI} |- NIL

We get: ¬S & (J v B v S) -> (J v B) & (¬B v ¬S) -> (J v ¬S) & \_\_\_\_ -> ????

Problem 2.19

A – I am guilty; P – I must be punished.

A -> P I= P -> A ; {A -> P, P} |= A ?? v(A)=0, v(P)=1 does not work

Proof System

A1 (A -> (B -> A)),

A2 ((A -> (B -> C)) -> ((A -> B) -> (A -> C))),

Rule: x, x-> y

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y

Proof that: A->A

B1 = ((A -> ((A -> A) -> A)) -> ((A -> (A -> A)) -> (A -> A))) Axiom A2

B2 = (A -> ((A -> A) -> A))

B3 = ((A -> (A -> A)) -> (A -> A)) (B1+B2)

B4 = (A -> (A -> A))

B5 = A -> A