Mincheol Sung

1. (1) Liveness, Good : goes up, Bad : comes down.
   (2) Liveness, Good : both can't enter CS at the same time, Bad : both enter CS.
   (3) Liveness, Good : at least one succeeds, Bad : no one succeeds.
   (4) Safety, Bad : A message is not printed.
   (5) Liveness, Good : a message is printed. Bad : a message is not printed.
   (6) Liveness, Good : clients may retain resources, Bad : clients may not retain.
   (7) Liveness, Good : taxes, Bad : death.
   (8) Liveness, Good : cloud? Bad : rain?

2. After feeding on the pond, Bob may pull the strings to bring the can to him. Alice can release her pets when Alice can't see the can on her side. When the can is on Alice's side, it means that Bob is feeding. After the can disappear, Alice will release her pets and after she recapture her pets, Alice will pull the string to bring the can on her side. This will be a signal that Bob can start feeding.

3. 1. A man is designated to a manager. I will call him "A".
   2. I will call the other men "B".
   3. Only "A" can turn the switch off.
   4. "B" only turn switch on once in their visits.
   5. They all agree with it when they meet together.
   6. If the switch is already on when "B" visit the room, "B" just leave the room.
   7. "B" can turn the switch on only when the switch is off. "B" has one chance to turn the switch on.
   8. In "B"'s next visit, if "B" find the switch is off, "B" can turn the switch on.
   9. "A" will arbitrarily visit the room and check whether the switch is on.
   10. When the switch is on, "A" will count it and turn the switch off.
   11. When "A" counts to (P – 1), it means that everyone has visited the room at least once.

- Same process as the previous one, but "B" have 2 chances to turn the switch on. "A" will count to 2(p-1) and then declare every prisoners has visited at least one time.

4. The prisoners agree that if the first prisoner sees an odd number of red hats, he will say "red". Next prisoner knows whether the number of red hats is odd number or not. If he sees even number of hats in front of him, his hat is red and Vice-versa. This way, the other prisoners will know their own hat color after the prisoner behind them responds. In this way, the first prisoner will survive in 50%. However, other P-1 prisoners will survive in 100%.

5. From Amdahl's law, $S_n = \frac{1}{(1-p)+\frac{p}{n}}$ (p = parallel fraction, n = # of cores)

$$S_2 = \frac{1}{(1-p)+\frac{p}{2}}$$

$$\frac{1}{S_2} = (1-p)+\frac{p}{2}$$

$$\frac{1}{S_2} = \frac{(2-p)}{2}$$

$$\frac{2}{S_2} = (2-p)$$

$$p = 2 - \frac{2}{S_2}$$

$$\therefore S_n = \frac{1}{(1-p)+\frac{p}{n}} = \frac{1}{\left(1-2+\frac{2}{S_2}\right)+\frac{2-\frac{2}{S_2}}{n}} = \frac{n*S_2}{(2-n)S_2+2n-2}$$

6. From Amdahl's law, $S_{16} = \frac{1}{(1-p)+\frac{p}{16}} = \frac{16}{16-15p}$

For S_{16} > 8, that is $\frac{16}{16-15p} > 8$, then p should be larger than $\frac{14}{15}$

If p is less than $\frac{14}{15}$, then the uniprocessor is better,
If p is larger than $\frac{14}{15}$, then the 16-core multiprocessor is better.

7. Let s = sequential fraction. (s = 1 – p : p is parallel fraction)

From Amdahl's law, $S_n = \frac{1}{s+\frac{(1-s)}{n}}$

Sequential part is optimized to run nine times faster, then it costs $\frac{T_0}{4}$,
that is Speed up = $4 = \frac{1}{\frac{s}{9}+\frac{(1-s)}{n}} = \frac{9n}{(n-9)s+9}$

$$\frac{1}{4} = \frac{(n-9)s+9}{9n}$$

$$\frac{9n}{4} = (n-9)s+9$$

$$9n = 4(n-9)s+36$$

$$\therefore s = \frac{9n-36}{4(n-9)}$$

If N = 6, then s = -1.5
It can't happen, because s can't be negative.
N should be less than 4.