

1 Introduction

Below are the answers to the handout. Please feel free to ask questions if anything is confusing.

2 Warm-up Puzzles

1. "1000 = 888 + 88 + 8 + 8 + 8"
2. Nicholas
3. Tallest is Charlie. Second tallest is Alex.
4. Markett
5. 4

3 Truth or Lie?

1. Box 2
2. Thursday
3. (2010 AMC 10) 3

4 Burning a Rope

You have a lighter and two ropes. Each rope burns up in 60 minutes from end to end. The rope does not burn evenly, so this does not mean that half of the rope burns in 30 minutes, for example.

1. Burn one rope from one end then burn the other rope as soon as the first one is fully burnt. After the second rope is fully burnt, 120 minutes have passed.
2. Lighting both sides of a rope at the same time will burn the rope twice as fast. By the time the rope fully burns, 30 minutes have passed.
3. **(Hard)** With our first rope, light both sides at the same time. At this time, also light one side of the second rope. As above, by the time the first rope fully burns, 30 minutes will have passed. This means that the second rope is halfway through burning. At this point in time, light the other side of the second rope. This will burn the remaining rope twice as fast. The remaining rope will burn in 15 minutes. When the second rope fully burns, 45 minutes have passed.

5 Standing in a Line

1. 7
2. Yes. We consider if there exists a case where there is no hat-wearing person in line who sees a non hat-wearing person ahead of them. For this to happen, we see that the second person in line must not be wearing a hat. By the same reasoning, the third person must also not be wearing a hat. This would also apply to the fourth, fifth, and so on places in the line, meaning that the only way this would happen is if every person in line would not wear a hat. However, I am wearing a hat and am standing somewhere behind the first person, so there then must exist a case where a hat-wearing person sees a non hat-wearing person in front of them.
3. **(Hard)** Black

4. **(Hard)** The answer is that the group can agree for the person in the back to say his hat is "red" if he sees an odd number of red hats in front of him (out of the 9 people) and "blue" if he sees an even number of red hats in front of him. From this, every other person will know what their hat color would be. This is a very tough problem to wrap your head around. A nice, illustrated explanation can be found in [this Ted Talk](#)