Best, Least, Fastest Puzzlers

1. You can drop a nut to the ground from any floor of a 100-story building. A nut will always break when dropped from higher than a certain unknown threshold floor. You have two identical nuts, and you can experiment by dropping them from different floors, but once a nut is broken you can't use it again. Present an algorithm to find the threshold floor that uses as few drops as possible in the worst case.

2. A family of 4 plans to cross the river at night. An old rope bridge spans the river. The mother can cross this bridge in 1 minute, the father in 2 minutes, the small child in 5 minutes, and the grandmother in 10 minutes. Unfortunately, the bridge can't hold more than two people at a time. The family has just one flashlight, and those people who are crossing the bridge must have the flashlight with them.

   What is the shortest time that it can take for the family to cross the river?

   Take into account a few restrictions. If two people are crossing the river at the same time, then they walk with the speed of the slowest person in the pair. It is not possible to cross the river without the flashlight. It is not possible to toss the flashlight to the other side of the river. A person on the shore cannot light the path of those who are on the bridge. A person cannot carry another person across the bridge.

3. You have a frying pan that holds at most 10 hamburgers at the same time. Each burger needs to be cooked for 5 minutes on each side. Each burger has two sides. What is the shortest time it takes to cook 17 hamburgers?

4. A farmer grows bananas in a desert oasis. He has 3000 bananas and the market is 1000 miles away. He has only a camel to transport bananas, but there are two problems:

   a) The camel can only carry at most 1000 bananas at a time.

   b) The camel will only walk if munching on a banana. He eats one banana for every mile he walks.

   What is the maximum number of bananas the farmer can get to the market using ONLY the camel to transport them? Hint: The farmer may carry bananas partway, drop off a supply of bananas, walk back to start (make sure the camel has enough bananas to do this!) re-boost his supply, and so on.

5. You are trapped in a room with 10 gumball machines full of gumballs, lots of change, and one digital scale that weighs things in ounces. Nine of the machines contain gumballs that all weigh exactly one ounce, but one machine is defective and its gumballs weigh only half an ounce. The scale is highly accurate, but takes a very long time, say 5 hours, to register the weight. You have to figure out which gumball machine is defective to be released, so you want to do this in the least amount of time, that is, with the fewest number of weighings. The defective gumballs look, feel, and taste just like normal gumballs.

6. A military base has a number of identical hoverplanes. Each hoverplane can carry enough fuel to fly exactly halfway around the planet. Hoverplanes do not use any fuel while hovering stationary in the air, and hoverplanes can transfer any amount of fuel between each other while in the air. What is the minimum number of planes are that are needed so that one plane is able to get all the way around the planet and all assisting planes return safely to base.