**Bags of Gold**

A king in a far off land collected all of the gold in his kingdom and placed it in 8 bags. All of the bags weighed exactly the same, and this was confirmed by using the king’s royal balance scale. The 8 bags of gold were entrusted to 8 court-appointed gold keepers.

Months passed and all was well, but the king became alarmed when news arrived that a merchant from the East had been paid in gold for horses she had sold in the local market place. Since all of the gold in the kingdom had been collected and stored in one of the 8 bags, the king knew he had been robbed by one of the gold keepers.

The king summoned the 8 gold keepers and collected the 8 bags of gold. The king would use the royal balance scale to discover which of the bags was lighter than the rest. **But how was the king to weigh the bags?** A reward was offered to any subject in his kingdom who could use the balance scale to find the "light" bag. In case of a tie, the reward would go to the subject who used the balance scale the least number of times.

"Whenever a bag of gold was added or removed from either side of the balance scale it was counted as a comparison."

**CLARIFICATION ADDED:** The number of times the scale is used is equal to the number of comparisons. So, if you are removing 3 bags from the scale at one time, and recording the result, this counts as 1 comparison NOT 3.

**ANSWER** these three questions in your write-up.

Question #1: How many ways can you find to discover the "light" bag? You need to include at least 3 solutions.

Question #2: What is the least number of comparisons necessary to find the "light" bag? This would be considered the “best” method.

Question #3: What is the least number of comparisons necessary to find the "light" bag if there were only 3 bags? 15 bags? 16 bags, 32 bags? n bags

**Find a recursive or explicit generalization** (formulas here...) for this algorithmic thinking problem.

A programming solution may be included, but I am looking for some mathematical formalism here.

Once you have a few solutions, check the link that explains how this assignment is to be written-up...Hardcopy, word processed. **No handwritten assignments will be accepted.**