3.1. This problem is simply a binomial distribution. To represent the number 'n' we would need 2^n bags. For example:

- Number 0 => 2^0 bags = 1 bag
- Number 1 => 2^1 bags = 2 bag
- Number 2 => 2^2 bags = 4 bag
- Number 3 => 2^3 bags = 8 bag
- Number 4 => 2^4 bags = 16 bag
- Number 5 => 2^5 bags = 32 bag
- Number 6 => 2^6 bags = 64 bag
- Number 7 => 2^7 bags = 128 bag
- Number 8 => 2^8 bags = 256 bag

3.2. The professor will need to carry 2^{64} bags in his vehicle.

- If each bags weights 4 grams, then he will need to carry 2^{64} * 4g / 1000kg / 1000 = tons
- This is equal to 18446744073709551616 * 4g / 1000kg / 1000 = tons
- The total number of tons is: 7.3786976294838206464 × 10^13 tons

3.3. To prove the number of bags needed to represent the number 'n' the formula I have derived is:

- $For\ b = number\ of\ bags\ needed\ to\ represent\ \ 'n'$
$$b = 2^n$$
- The base case is:
$$For\ n = 0, \qquad b = 2^0 = 1$$
- $For\ n = 1,$
$$2^0 + 2^{n-1} = 2^0 + 2^0 = 2$$
- $For\ n = 2,$
$$2^0 + 2^{n-1} + \ 2^{n-2}$$
$$2^0 + (2^0 + 2^0) + \ 2^0 = 4$$
- $For\ n = 3,$
$$2^0 + 2^{n-1} + 2^{n-2} + 2^{n-3}$$
$$(2^0) + (2^0 + 2^0) + \ (2^0 + 2^0 + 2^0 + \ 2^0) + 2^0 = 8$$
We can see that this is simply the sum of the previous sets.
I have grouped the sets using parenthesis to denote each set starting with n=0. Finally we add a final $2^{0.}$

- As can be seen from the pattern above the formula is equal to:
$$b = \sum_{i=0}^{n-1} 2^i + 2^0$$
- As we can see, because this hold true for the base case (n=0), then it must be true for when n=n+1. As we see above, this continues to hold throughout.