The Price of Chess

The powers of 2:

$2^2 = 4$

$2^3 = 8$

…

$2^{10} = 1{,}024$

…

$2^{20} = 1{,}048{,}576$

…

$2^{50} = 1{,}125{,}899{,}906{,}842{,}624$

According to legend, the Indian mathematician who invented the game of chess was allowed to choose a reward by the emperor.

He requested that the emperor give him one grain of rice for the first square of the chessboard, two for the second, four for the third and so on, doubling every time.

1) How many grains of rice would there be for the 10ᵗʰ square of the board?

2) How many altogether on the first half of the chessboard?
hint: 1 + 2 + 4 = 8 - 1 and 1 + 2 + 4 + 8 + 16 = 32 - 1

3) Assuming a grain weighs 20mg, what would the weight of this be?

The total number of grains on the chess board would be 18,446,744,073,709,551,615. That's around 370 billion tonnes, which is equivalent to 500 years' of global rice harvest, and would be worth just over £100 trillion. That's about 10 times the value of all the gold ever mined, and 300 times more money than the richest person who ever lived (Mansa Musa, who lived in the 14ᵗʰ century and owned half of Africa).