Let us define B[i] as the number of days Richard can choose the i'th coin such that its value remains non-negative. Let S denote the sum of B[i]'s.

Now the problem can be divided into 2 cases.

Case 1: S >= M

Since Richard can choose any subset of coins each day, he can choose every coin until its value becomes negative or until M days are over.

Case 2: S < M

In this case, we can clearly see that Richard is forced to choose coins having negative values (even if Richard chooses 1 coin per day, the values of all the coins will become negative before M days). Naturally, Richard will choose only 1 coin per day so that on a whole, he chooses least number of negative valued coins.

So when all the values become negative, Richard would pick the coin with maximum value each day. But since M is large, brute force wouldn't pass. Intuitively, it would be better to make all the values as close as possible to each other (if the values are scattered, Richard would pick the largest value which would decrease and thus go closer to other values). Here is the interesting part!

Let us find the least number L such that all the final values of the coins are in the range [L, L + K). If the total number of days required to reduce each coin's value from its initial value to the range [L, L + K), say D is greater than M, that means we need to increase L and if D is lesser than M, then we can decrease L. This clearly hints towards binary search for the number L.

Once we find the number L, we can be sure that Richard will reduce all the values to the range [L, L + K) such that D <= M. Let us look at an upper bound for M – D. If M – D >= N (D + N <= M), Richard could have chosen all the coins across N days, each one a day and the final values would be in a range [L – K, L) which contradicts the minimality of L obtained from binary search. Thus M – D < N. Now, we can greedily choose the maximum value for the next M – D days as this time we are sure that M - D < N.

Time Complexity: O(NlogN + log(10^18))

Space Complexity: O(N)

Here is the code: http://ideone.com/lmsdW0