1. How many steps did all residents of San Francisco take over the last decade? Give an answer and explain your reasoning.

First we need estimates of the population of San Francisco. Every time I hear the number it seems to be just north of 700 thousand. For simplicity we will assume the population has been stable for 10 years. I could justify that with the city going through two recessions across those 10 years.

The foundation for my approximation will be based on the average SF resident as a Muni rider. For the sake of this estimation, let's assume that everyone over the age of 10 and under the age of 60 works or commutes to school. Based on some quick internet estimates, the remainder is about 70% of a population. Of course with drop out rates and labor force participation rates, lets take only about 65% of those. So from our initial resident numbers, we have 700,000 *.70 *.65 = 318,500 active school age and working adults in the city.

My estimate of the average distance for a resident to a Muni stop is about 2 blocks. I will also assume that the average rider walks 2 more blocks to work, this makes for a daily commute walk of 8 blocks. If the average pace is about 2.5 feet we next need an estimate of block length. As an Inner Sunset resident I know the answer to this question varies quote a bit whether you're walking east-west or north-south, but for the sake of estimate we will assume that all city blocks are the same length on average. Some internet averaging reveals a typical city block at about 300 feet or 100 yards.

So, let's do our first quick estimation. Based on work day commute walks by the working and school age population of San Francisco.

Estimate:

300	Feet block length
8	Blocks per day
260	Commute days
624,000	Feet per year per resident
318500	Active working and school age residents
198744000000	Total walked feet per year
10	Years
1,987,440,000,000	Total walked feet last decade
2.5	Average pace in feet
794,976,000,000	!!!!!!!!

Around 800 billion steps or "paces" is my estimate. I bet it would double if we take into account tourist steps.

2. What's the probability that 2 people randomly sampled from the U.S. population with replacement have the same first name, last name and birthday? What's the probability that they are the same person.

I am not 100% on this, but here is my best guess. I see this as just an expansion of the classic questions of the probability that someone in a group of n people has the same birthday has me. As such, we need the total possible combination of birthdays, last names and first names and need estimates for those names. I found some estimates for number of unique first and last names. 150,000 last names and about 5000 first names.

Also, instead of asking about two random people, let's make it a bit more intuitive and restate the question as, "what is the probability that someone else in the US has my information?" It still satisfies the two random picks, just that I am the first random pick.

Next, to make the analytical solution easier, we should find the probability that nobody else shares the same information as me, and then subtract that value from 1. The complement of nobody having my information is one person having my information.

We need two very large numbers as numerator and denominator, basically all the different combinations possible for birthdays, and the first and last names for the US population. That is: 365 birthdays * 150,000 last names * 5000 first names all powered to our n, which in this case is 315 million. That is our denominator. In the numerator, it will simply be the total number we found above minus 1 (for me) then to the power of 315 million. Then of course, subtract that entire fraction from 1 to get our original probability of interest.

P(Someone else shares my birthdate (month and day), first and last name) =

$$1-\left(\frac{((365*150{,}000*5000)-1)^{315million}}{(365*150{,}000*5000)^{315million}}\right)$$

And for the second part of the question, I believe that with replacement, the chance of drawing the same actual person again is simply 1 in 315 million.