MATH 308 Exercises 1.11

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2

a)

Observational study.

b)

No, because of the possibility of confounded effects.

3

c)

Observational study.

d)

No.

e)

No, because the study sample was a selected non-random sample of the population.

5

Number of unique subsets of size N is $\binom{N}{n}$.
The number of unique subsets that include a given individual is $\binom{N-1}{n-1}$.
$\therefore$ Required probability$= \binom{N}{n}/\binom{N-1}{n-1} = \frac{n}{N}$ $\square$

This formula does not change with the individual. Therefore, by symmetry, every person has an equal chance of being in the group $\square$.

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f)

From (5), with $N = 10^8$ and $n = 10^3$, required probability $p = n/N = 10^{-5}$.

g)

Probability of not being in any of 2000 independently chosen samples $= (1-p)^{2000} \approx 98\%$.

h)

A half-chance of being in at least one sample implies a half-chance of being in no samples. So, if t samples are chosen,

$$\begin{aligned} & q^t = 0.5 \\ \implies \quad & t \log q = \log 0.5 \\ \implies \quad & t = \frac{\log 0.5}{\log(1-10^{-5})} \\ & = 69315 \end{aligned}$$