

Math 263: Excel Assignment 4 (Probability)

You must do the computer work for this assignment yourself, although you may certainly talk to other people. Answers which appear to be copied will be treated as an integrity violation.

1. China's one child per couple policy has been in effect since 1979. However, in rural areas where couples particularly want a boy, families may be allowed to have two children if the first one is a girl. Assume that 51.5% of births are boys.¹
 - (a) Consider 1000 rural families who will have a second child if the first is a girl.
 - i. How many of the families have just one child?
 - ii. Of the families with two children, how many have two girls and how many have one child of each sex?
 - (b) Using the results from part (a), find
 - i. The number of children in these 1000 families.
 - ii. The proportion of boys among the children of these families.
 - (c) Explain why the answer to (b) (ii) is to be expected.

Postscript:

The one child policy, while having successfully slowed China's population growth, has had some side effects.² The desire for a son has led to selective abortion, causing the sex ratio of births to grow from 1.06:1 in 1979 to 1.19:1 in 2006.³ There is also concern about the "4:2:1 phenomenon", where one couple supports four parents and one child.

¹"Industrialized countries generally have a natural ratio between 1.03 and 1.07 to 1, not 1:1.

² See "The Effect of China's One-Child Family Policy after 25 Years" *New England Journal of Medicine*, Therese Hesketh, et al, Sept 15, 2005.

³National Bureau of Statistics of China, www.stats.gov.cn

2. In this problem you will see the implications of changing China's once child per family in a different way than the policy for rural areas described in Problem #1. In this problem, suppose the policy is changed to one in which families can have children until they have a boy; then they must stop. (So they may have three children if the first two are girls, etc.) Assume that 51.5% of the births are boys.

(a) Do you expect this new policy to lead to a larger or smaller number of children per family than the policy in Problem #1? Why?

(b) Do you expect this new policy to lead to a large or smaller proportion of boys than the policy in Problem #1? Why?

You can analyze the effects of such a policy by completing the file *ChildBirthPolicy.xlsx* which contains an Excel simulation of the policy. The file has been started; you will first want to see how it has been constructed, and then complete the blue cells (B9:B24), the green cells (J7:L22), and lastly the pink cells (L25:L26). You should also change the proportion of male births, currently set at 0.5, to the more realistic figure of 0.515. We assume the sexes of births siblings are independent.

(c) What is the formula to calculate the probability of a family having five children? Six children? Answer using numbers, not an Excel formula. (The answer should be an expression that can be evaluated in one step on a calculator.)

(d) Calculate the average number of children in a family under this policy. (The top pink box.)

(e) Calculate the proportion of boys among children under this policy. (The second pink box from the top.)

Note: You do not need to hand in your Excel sheet with the answers to your questions.