Example 4 – A couple plans to have children until they have a girl or until they have three children. What is the probability they will have a girl among their children?

Simulation:

- Step 1: Probability Model
  - P(girl) = 0.49
  - P(boy) = 0.51

More boys than girls are born. Boys have higher infant mortality so sexes even out.

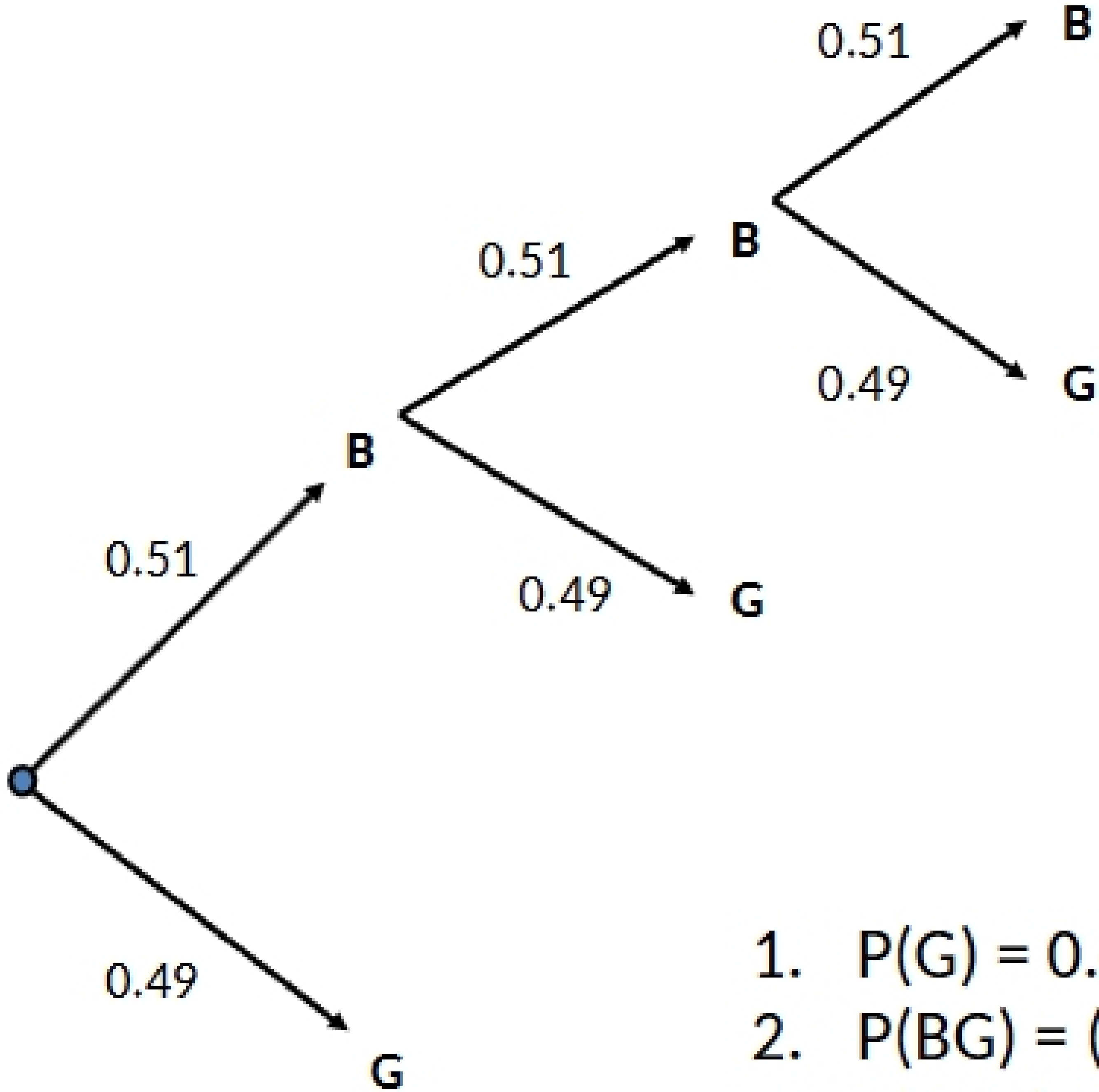
- Step 2: Assign digits
  - 00, 01, 02, …, 48 = girl (49/100 = 0.49)
  - 49, 50, 51, …, 99 = boy (51/100 = 0.51)
- Step 3: Simulate repetitions
- From table of random digits:

69 05	16	48	17	87 17	40	95 17	84 53 40	64 89 87	20
B G	G	G	G	B G	G	B G	B B G	B B B	G

- Estimated probability P(at least one girl) = 9 / 10 = 0.90
- True probability is 0.867

Tree Diagram

- **Tree Diagram**
  - Useful tool for organizing more complicated probabilities
  - Graphical form R
  - Represents different stages of a probability model by different "branchings"
  - Multiplication up the branches denotes intersections of events (considering conditions)
  - Adding the resulting intersections' probabilities can give us the probability of a union
- Compute true probability this couple will have a girl



1. $P(G) = 0.49$
2. $P(BG) = (0.51)(0.49) = 0.250$
3. $P(BBG) = (0.51)^2(0.49) = 0.127$

$$P(G \text{ in three}) = 0.49 + 0.250 + 0.127 = 0.867$$