KSooklall Homework10

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4/5/2021

Smith is in jail and has 1 dollar; he can get out on bail if he has 8 dollars. A guard agrees to make a series of bets with him. If Smith bets A dollars, he wins A dollars with probability .4 and loses A dollars with probability .6.

Find the probability that he wins 8 dollars before losing all of his money if

(a) he bets 1 dollar each time (timid strategy).

States 0 and 8 are absoring states

```
states <- c("0", "1", "2", "3", "4", "5", "6", "7", "8")
tmatrix <- matrix(c(1, 0, 0, 0, 0, 0, 0, 0, 0,
                    0.6, 0, 0.4, 0, 0, 0, 0, 0, 0,
                    0, 0.6, 0, 0.4, 0, 0, 0, 0, 0,
                    0, 0, 0.6, 0, 0.4, 0, 0, 0, 0,
                    0, 0, 0, 0.6, 0, 0.4, 0, 0, 0,
                    0, 0, 0, 0, 0.6, 0, 0.4, 0, 0,
                    0, 0, 0, 0, 0, 0.6, 0, 0.4, 0,
                    0, 0, 0, 0, 0, 0, 0.6, 0, 0.4,
                    0, 0, 0, 0, 0, 0, 0, 0, 1),
                    nrow = 9,
                    byrow = TRUE,
                    dimnames = list(states, states))
s0 <- c(0, 1, 0, 0, 0, 0, 0, 0, 0)
for (i in 1:10) {
  s0 <- s0 %*% tmatrix}
s0[9]
```

```
## [1] 0.003997696
```

The probability that he wins 8 dollars before losing all of his money by betting 1 dollar each time is ~2%.

(b) he bets, each time, as much as possible but not more than necessary to bring his fortune up to 8 dollars (bold strategy).

```
tmatrix <- matrix(c(1, 0, 0, 0, 0, 0, 0, 0, 0,
                    0.6, 0, 0.4, 0, 0, 0, 0, 0, 0,
                    0.6, 0, 0, 0, 0.4, 0, 0, 0, 0,
                    0.6, 0, 0, 0, 0, 0, 0.4, 0, 0,
                    0.6, 0, 0, 0, 0, 0, 0, 0, 0.4,
```

```
                    0, 0, 0.6, 0, 0, 0, 0, 0, 0.4,
                    0, 0, 0, 0, 0.6, 0, 0, 0, 0.4,
                    0, 0, 0, 0, 0, 0, 0.6, 0, 0.4,
                    0, 0, 0, 0, 0, 0, 0, 0, 1),
                    nrow = 9,
                    byrow = TRUE,
                    dimnames = list(states, states))

s0 <- c(0, 1, 0, 0, 0, 0, 0, 0, 0)
for (i in 1:50) {
  s0 <- s0 %*% tmatrix}
s0[9]
```

```
## [1] 0.064
```

The probability that he wins 8 dollars before losing all of his money by betting as much as possible but not more than necessary each time is ~6%.

(c) Which strategy gives Smith the better chance of getting out of jail?

The bold strategy is 3x more likely than the timid strategy to allow Smith to get out of jail.