# Data 605 Homework #10

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## Question

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 0.4 and loses A dollars with probability 0.6.

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

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

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

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

## Work and Answers

### A

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

```
timid = function() {
  p = numeric(9)
  p[1] = 0
  p[9] = 1

  for (iter in 1:10000) {
    for (j in 2:8) {
      p[j] = 0.4 * p[j + 1] + 0.6 * p[j - 1]
    }
  }
  return(p[2])
}

timid_p = timid()

cat("The Probability of Smith getting out of jail using timid strategy is", timid_p,"or", timid_p *100,
```

```
## The Probability of Smith getting out of jail using timid strategy is 0.02030135 or 2.030135 %
```

### B

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

```r
bold = function() {
  p = numeric(9)
  p[1] = 0
  p[9] = 1

  for (iter in 1:10000) {
    for (j in 2:8) {
      A = min(j, 8 - j)
      if (j + A <= 8 && j - A >= 1) {
        p[j] = 0.4 * p[j + A] + 0.6 * p[j - A]
      } else if (j + A > 8) {
        p[j] = 0.4 * p[8] + 0.6 * p[j - A]
      } else if (j - A < 1) {
        p[j] = 0.4 * p[j + A] + 0.6 * p[1]
      }
    }
  }
  return(p[2])
}


bold_p = bold()


cat("The probability of Smith getting out of jail using bold strategy is", bold_p,"or", bold_p*100,"%\n
```

```
## The probability of Smith getting out of jail using bold strategy is 0 or 0 %
```

## C

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

```r
if (timid_p > bold_p) {
  cat("The timid strategy gives Smith a better chance of getting out of jail.")
} else {
  cat("The bold strategy gives Smith a better chance of getting out of jail.")
}
```

```
## The timid strategy gives Smith a better chance of getting out of jail.
```