

Assignment 10

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```
library(tidyverse)
library(pracma)
library(glue)
library(stats)
```

Problem 1

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:

- he bets 1 dollar each time (timid strategy).
- he bets, each time, as much as possible but not more than necessary to bring his fortune up to 8 dollars (bold strategy).
- Which strategy gives Smith the better chance of getting out of jail?

Information

Taking the timid strategy transforms this into a Gambler's Ruin problem. So we can utilize the Gambler's Ruin formula turned into a function below:

```
p <- 0.4
q <- 1-p
z <- 1
M <- 8
gam_ruin <- function(p,q,z,M) {
  return (
    ((q/p)**z - 1) / ((q/p)**M-1)
  )
}
```

Attempt A

If Smith takes the timid strategy he has a **0.0203 probability** of winning his bail before losing all his money.

```
(gam_ruin(p,q,z,M))
```

```
## [1] 0.02030135
```

Attempt B

If Smith takes the bold strategy, he loses all his money after a single failure. This means we are simply looking for the probability of 3 successes in a row without any failures to get to \$8.

If Smith takes the bold strategy he has a **0.064 probability** of winning his bail before losing all his money.

```
( (p**3)*(q**0) )
```

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

Attempt C

The **bold strategy** gives Smith the better chance of getting out of jail.