Probability that first head appears on n^{th} toss

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First try: 1/2

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Second try: 1/2*1/2 = 1/4

Probability that first head appears on n^{th} toss

First try: 1/2
Second try: 1/2*1/2 = 1/4
Third try: 1/4*1/2 = 1/8

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n^{th} try: $1/2^n$

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n^{th} try: $1/2^n$

Probability that it comes up heads at least one time =

1/2 + 1/4 + 1/8 + 1/16 + ...

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Second try: 1/2*1/2 = 1/4
Third try: 1/4*1/2 = 1/8
...
n^{th} try: $1/2^n$

Probability that it comes up heads at least one time =

s= 1/2 + 1/4 + 1/8 + 1/16 + ...

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Second try: 1/2*1/2 = 1/4
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n^{th} try: $1/2^n$

Probability that it comes up heads at least one time =

s= 1/2 + 1/4 + 1/8 + 1/16 + ...
s= 1/2 + 1/2(1/2 + 1/4 + ...

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First try: 1/2
Second try: 1/2*1/2 = 1/4
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n^{th} try: $1/2^n$

Probability that it comes up heads at least one time =

s= 1/2 + 1/4 + 1/8 + 1/16 + ...
s= 1/2 + 1/2(s)

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Second try: 1/2*1/2 = 1/4
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...
n^{th} try: $1/2^n$

Probability that it comes up heads at least one time =

s= 1/2 + 1/4 + 1/8 + 1/16 + ...
s= 1/2 + 1/2(s)
s/2 = 1/2
s=1

Probability that a grill lights on the n^{th} try

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Suppose the probability that it lights on a single try is p

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First try: p

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p
Second try: $(1-p)p$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p

Second try: $(1-p)p$

Third try: $(1-p)^2p$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p

Second try: $(1-p)p$

Third try: $(1-p)^2p$

Fourth try: $(1-p)^3p$

Probability that a grill lights on the n^{th} try

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Second try: $(1-p)p$
Third try: $(1-p)^2p$
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Probability that a grill lights on the n^{th} try

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First try: p
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...
n^{th} try: $(1-p)^{n-1} p$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p
Second try: $(1-p)p$
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Fourth try: $(1-p)^3p$
...
n^{th} try: $(1-p)^{n-1}p$

Probability that it lights at some point =
$s = p(1 + (1-p) + (1-p)^2 + \ldots)$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p
Second try: $(1-p)p$
Third try: $(1-p)^2p$
Fourth try: $(1-p)^3p$
...
n^{th} try: $(1-p)^{n-1}p$

Probability that it lights at some point =
$s = p(1 + (1-p) + (1-p)^2 + ...)$
$s = p + (1-p)*p*(1 + (1-p) + (1-p)^2 + ...$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p
Second try: $(1-p)p$
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Probability that it lights at some point =

$$s = p(1 + (1-p) + (1-p)^2 + \ldots)$$
$$s = p + (1-p)*p*(1 + (1-p) + (1-p)^2 + \ldots$$
$$s = p + (1-p)*s$$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

First try: p
Second try: $(1-p)p$
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Probability that it lights at some point =

$s = p(1 + (1-p) + (1-p)^2 + ...)$
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$s = p + (1-p)*s$
$p*s = p$

Probability that a grill lights on the n^{th} try

Suppose the probability that it lights on a single try is p

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Second try: $(1-p)p$
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Probability that it lights at some point =

$s = p(1 + (1-p) + (1-p)^2 + ...)$

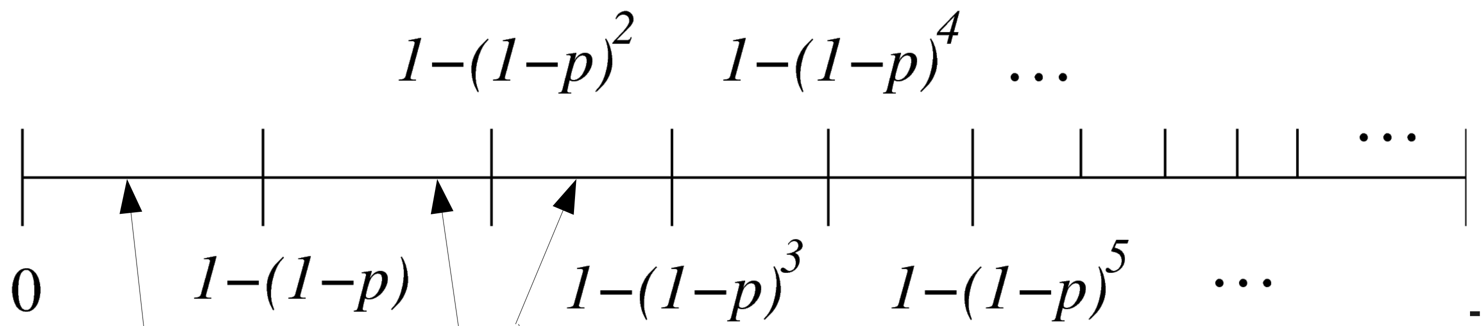
$s = p + (1-p)*p*(1 + (1-p) + (1-p)^2 + ...$

$s = p + (1-p)*s$

$p*s = p$

$s = 1$

How do we implement this in Matlab?



Probability it lights on 3rd try = $1-(1-p)^3 - (1-(1-p)^2) = p(1-p)^2$

Probability it lights on 2nd try = $1-(1-p)^2 - (1-(1-p)) = p(1-p)$

Probability it lights on 1st try = p

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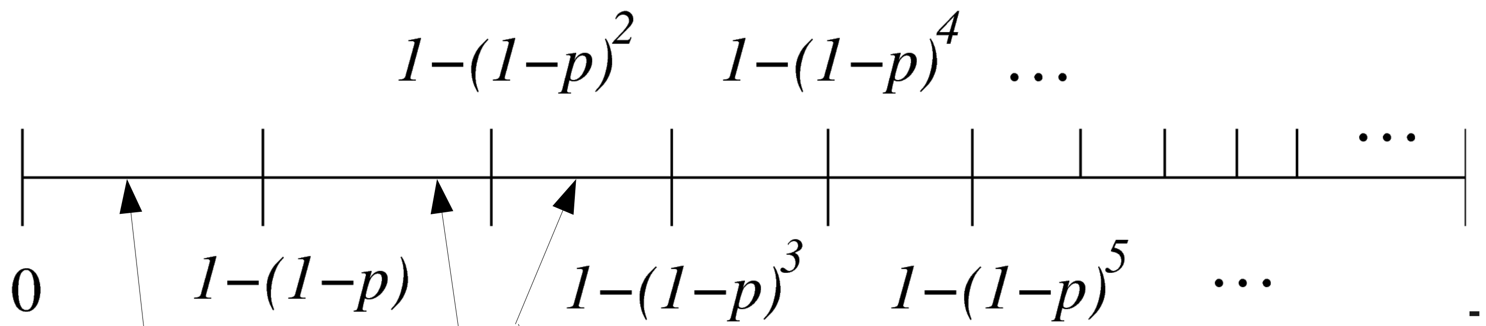


Probability it lights on 3rd try = $1\text{-}(1\text{-}p)^3 - (1\text{-}(1\text{-}p)^2) = p(1\text{-}p)^2$

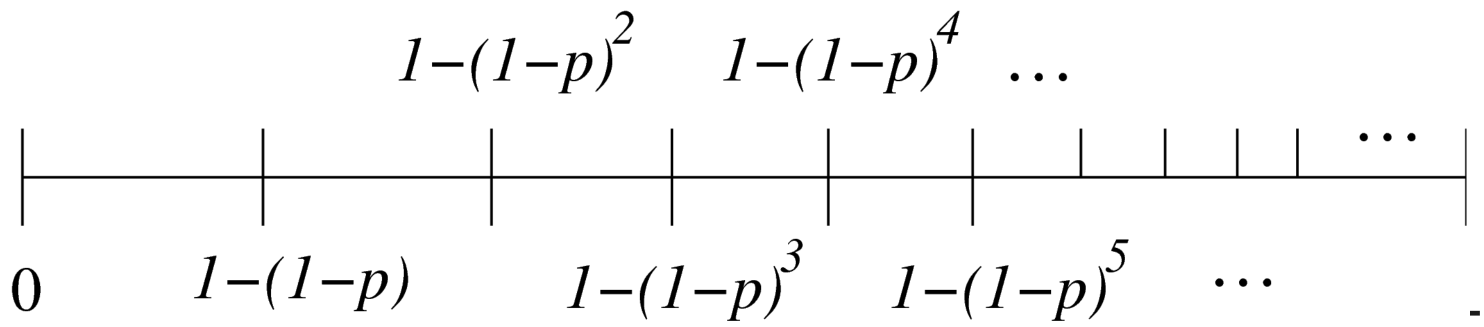
Probability it lights on 2nd try = $1\text{-}(1\text{-}p)^2 - (1\text{-}(1\text{-}p)) = p(1\text{-}p)$

Probability it lights on 1st try = p

Code that returns a geometrically distributed random number of mean *1/p*

```
function res = getRand (p)
   s = 1;
   t = rand(1);
   res = 1;
   while !(1-s <= t && t < 1-s*(1-p))
      s = s*(1-p);
      res = res+1;
   end
end
```

How do we implement this in Matlab?



But we use a continuous counterpart of the geometric distribution: if *X* is a random variable taken from a uniform distribution from 0 to 1, then relate *X* to *n* like this -

$$X = 1-(1-p)^n$$

where *n* is now a real number instead of an integer. Rearrange the equation above to get this:

$$n = \log(1-X)/\log(1-p)$$

The corresponding Matlab expression for generating n is:

```
n = log(rand(1))/log(1-(1/Mean));
```

since `rand(1)` and `1-rand(1)` give the same probabilities and *1/p* is the `Mean` of the distribution above.