

A Mathematical way to choose a toilet

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Introduction

You are in a music festival, and you need to use a toilet, unfortunately, the toilets are not so good, and you want to choose the best one under the next constraints:

- N toilets
- Once you reject a toilet, you cannot go back to it.



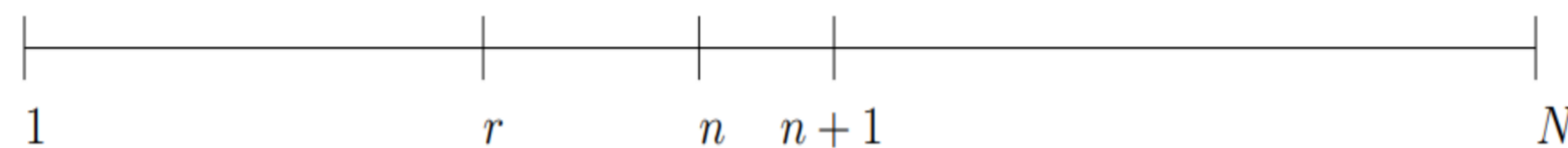
Materials and Methods

- Reject the first r toilets..
- Accept the very next toilet which is better than all the first you got to.
- Optimizing $P(r)=P(\text{success})$ by using $P'(r)=0$
- Riemann Integral Approximation

Result

N: the number of toilets.

Sr: the strategy to reject the first r toilets and accept the first very best one.



we obtain

$$P(r)=P(\text{success})=\frac{r}{N} \left(\sum_{i=r}^{N-1} \frac{1}{i} \right)$$

And we are ready to do some magic, the formula:

$$\sum_{i=r}^{N-1} \frac{1}{i}$$

is a Riemann approximation of the integral :

$$\int_r^{N-1} \frac{1}{x} dx$$

So we should then optimize P(r) by the formula $P'(r)=0$, and we find that :

$$\frac{r}{N}=0.37.$$



Conclusion

The solution of this problem is:

- Not always meaningful, because human decisions are not always some simple calculations.
- Useful, because at least, it can give a general idea about how to choose.

References:

The secretary problem decision solution details, Bryan Hernandez.
<https://thebryanhernandezgame.files.wordpress.com/2010/05/secretary-problem.pdf>

Image des Mathématiques, décision, Etienne Ghys.
<http://images.math.cnrs.fr/Decision.html?lang=fr>