Épreuve de section européenne

1 General knowledge

What kind of sequences do you know ? Give a few properties.

2 Document

Probability density functions

Probability density function
A probability density function is a function f defined on an interval (a, b) and having the following properties :

1. $f(x) \geq 0$ for every x ;
2. $\displaystyle\int_a^b f(x)\mathrm{d}x = 1$.

We allow a, b or both to be infinite.

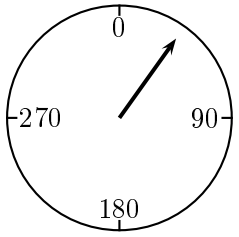
Probability associated with a continuous random variable
When a continuous random variable X is specified by a probability density function f, the probability $P(c \leq X \leq d)$ is equal to

$$P(c \leq X \leq d) = \int_c^d f(x)\mathrm{d}x.$$

3 Questions

1. What is the uniform density function on the finite interval $[a; b]$?

2. *Spinning a dial*
   Suppose that you spin the dial shown in the figure so that it comes to rest at a random position. Model this with a suitable distribution, and use it to find the probability that the dial will land somewhere between 5 and 300.



3. What is the name of the the probability distribution whose density function is defined by
   $$f(x) = \lambda e^{-\lambda x}$$
   on the interval $[0, +\infty[$, where λ is a positive real number ?

4. Suppose that the length of a telephone call (in minutes) is exponentially distributed with rate parameter $\lambda = 0.2$.
   Find the probability that the last call lasts between 2 and 7 minutes.

5. Explain the meaning of sentence "we allow a, b or both to be infinite".

Adapted from *www.people.hofstra.edu* and *www.ds.unifi.it*.