# The Binary distribution

The Binary distribution is concentrated in just two points. In most applications the Binary distribution as an “indicator” variable for a certain event. That is, the variable is either 0 or 1, and it is 1 if and only if the corresponding event actually occurs.

Assume e.g., that a certain project cost, K, contributes to the total cost only if an event E occurs. E may for instance be a certain accidental event. In other words, if E occurs, one has to pay the cost K, while if E does not occur, then K can be neglected.

Now, let X be 1 if E occurs and 0 otherwise. Assume that the probability of E is assessed to be p, some number between 0 and 1. The cost K itself may have a suitable lognormal distribution. The experienced cost may then be expressed as:

$$\text{Experienced cost} = H = X * K$$

Note that even though K is lognormally distributed, H is not. In fact there is a positive probability of (1-p) that H is exactly 0.

In the Binary distribution the key numbers, “a”, “b” and “c” are interpreted as follows:

“a”
=
Min. of two possible values.

“b”
=
The expected value.

“c”
=
Max. of two possible values.

To get a sensible distribution the specified values must satisfy:

$$\text{“a”} \leq \text{“b”} \leq \text{“c”}$$

If the key numbers are not ordered according to these rules, DynRisk will reorder them before doing any calculations.

Note! In the case of indicator variables, i.e., where “a” is 0 and “c” is 1, then the expected value is equal to the probability of getting the outcome ‘1’. Thus, in such cases it is fairly easy to specify the expectation, i.e., the “b” parameter. In the general case where the “a” and the “c” values are say A and C respectively, and the probability of the value C is assessed to be, say p, the expectation is given by the following formula:

Expectation = “b” = A(1-p) + Cp

Since p is always a number between 0 and 1, it follows that “b” always should be a number between “a” and “c”. Especially, if p is close to 1, then “b” is close to “c”, while if p is close to 0, then “b” is close to “a”.

If we are given the values of “a”, “c” and the expectation, “b”, say A, C and B respectively, we can calculate the corresponding probability, p of getting the “c” value using the following formula:

Probability of “c” = p = (B-A)/(C-A)