Simulation modeling

The number of failures of the software when working over the last 260 hours

The number of failures in 1 hour	2	3	4	5	6	
Frequency	30	50	80	60	40	260

Using a random number, selected using tables or random number generators, it is necessary to simulate the occurrence of failures of the software within 10 hours

Guidelines for solution:

Simulation modeling is a tool that allows to build the models describing processes close to reality. The results will be determined by the random nature of the process

Simulation is modeled by some random variable.

- **First, experimental data gives the frequency of occurrence of possible values of this variable.**
- **Then based on frequencies the probability is calculated => the cumulative probability.**
- **Knowing the cumulative probability, establish a correspondence between random numbers and the values of a random variable**

The probability of the event is determined by the formula

$$p_i = \frac{\omega_i}{N}$$

pi – the probability of the i event;
ωi – the frequency of realization of the i event;
N – the total number of events.

Cumulative risk is the sum of all peak probabilities, its value tends to 1. Depending on how many decimal places will have values of cumulative probability, we group the random numbers.

Iinear interpolation

Experts of Department of the threats analysis examined 6 companies and got the following results on the dependence between the number of leakage channels and the damage

The number of leakage channels	1	2	5	7	9	10
Damage $	120	155	179	280	310	450

Using linear interpolation, find the value of any damages, if the company has 6 channels of leakage.

Guidelines for solution:

Interpolation is a method of finding intermediate values of number according to the available discrete set of known values.

Linear interpolation is performed on the basis of formula $P_1(x) = ax + b$ of the function f, given in two points x_0 and x_1 of the interval [a, b]. The formula for linear interpolation is:

$$P_1(x) = f(x_0) + \frac{f(x_1) - f(x_0)}{x_1 - x_0} \cdot (x - x_0)$$

$P_1(x)$ - value of the function at the point x;
x - value of the point x;
x_0 - value of the start point of the segment;
x_1 -value of the end point of the segment;
$f(x_0)$ - value of the function at the starting point of the segment;
$f(x_1)$ - value of the function at the end point of the segment.

EXPONENTIAL SMOOTHING

The number of confidential information leakage from the public authorities of the region for the last 6 months

Month	1	2	3	4	5	6
Number of conf. inf. leakage	15	9	11	13	17	12

For the 1st month a forecast of 13 leaks was given (by information security professionals). Using a simple exponential smoothing model, give the forecast on the number of leaks on the 7th month, if the smoothing constant $\alpha = 0.8$

Guidelines for solution:

Exponential smoothing is a method of quickly getting the forecast for 1 period ahead, which automatically corrects any forecast in the light of differences between the actual and the predicted result

The new forecast is determined by the formula

$$F_{t+1} = \alpha \cdot A_t + (1 - \alpha) \cdot F_t$$

F_{t+1} is the forecast value for a new period; α - the smoothing constant in the interval [0; 1]; At - the actual value at the last period; Ft - the forecasted value in the last period

The greater α, the less the influence of the previous years. If the value of α is close to one, it leads to the taking into account only the latest observations.

$$\alpha = \frac{2}{n+1},$$

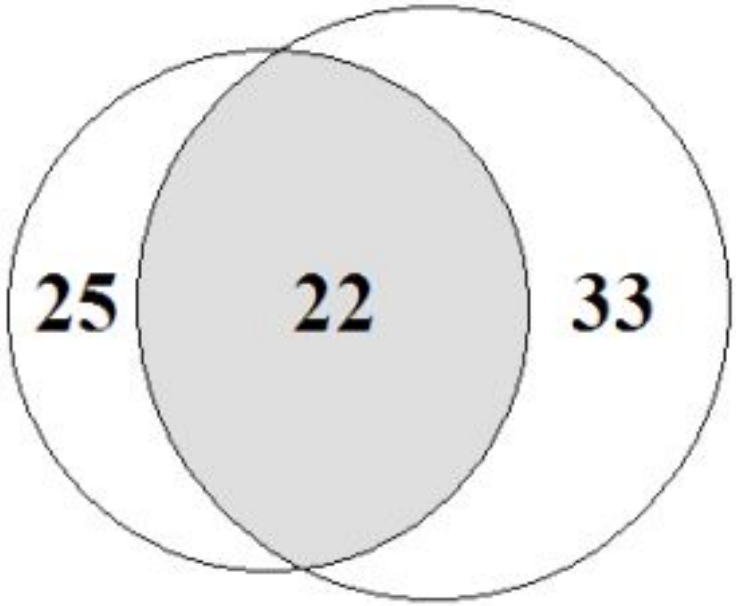
n – the number of observations included in the smoothing interval.

Uo (exponentially weighted average initial)
is solved in the following ways:
if there is data on the development of the phenomenon in the past, you can use the arithmetic average;
if there is no such information, the Uo is equated to the original first value in base forecast U1.

EVALUATION OF THE FORECAST RELIABILITY

You must provide the CEO report on the reliability of forecasts in the 1 part of the 2014, provided that the information security specialists predicted the emergence of 25 new types of malicious programs, and as a result, the monitoring system discovered 33 new species of malicious program, 22 of them coincided with the experts forecasts.

With the help of Euler circles depict schematically the conditions of the problem



Nпр = 25, Nнаст = 33, а Nнаст/пр = 22.

Guidelines for solution:

1. The degree of reliability of the forecast is characterized by credibility /reliability and accuracy, as well as the errors of the 1st and 2nd kind.

credibility /reliability

$$O = \frac{N_{наст/пр}}{N_{пр}} \cdot 100\%$$

Nнаст/пр – the number of occurred events, which was forecasted;

Nпр – the total number of events, which was forecasted.

Forecast accuracy

$$П = \frac{N_{наст/пр}}{N_{наст}} \cdot 100\%$$

Nнаст – the number of occurred events

If the event was predicted but did not occur, then this is an error of the 1st kind - α,

$$\alpha = \frac{N_{пр} - N_{наст/пр}}{N_{пр}} \cdot 100\%$$

If the event was not predicted, but occurred => error of the 2nd kind - β

$$\beta = \frac{N_{наст} - N_{наст/пр}}{N_{наст}} \cdot 100\%$$