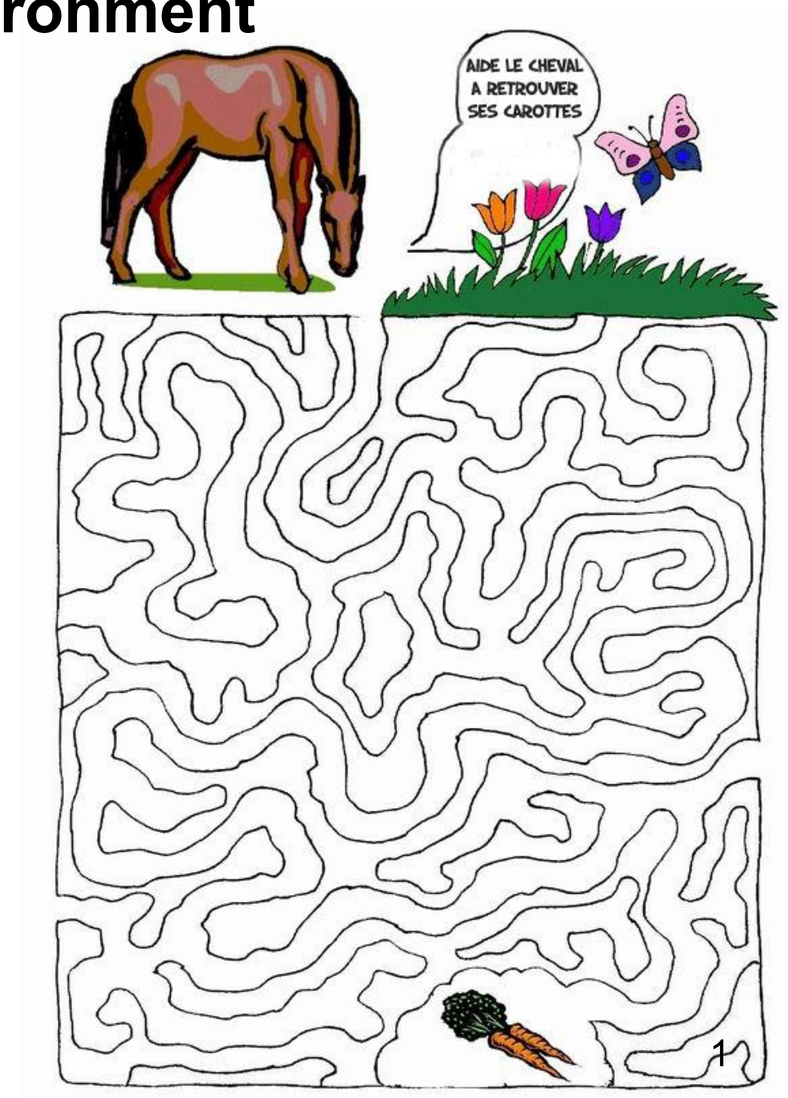
Decision environment

- **Certainty**
- **Risk**
- **Uncertainty**

Knowledge degree of a manager



How managers can make a decision in certainty environment?

Search for options with the maximum benefit or minimum costs is called the <u>optimization analysis</u>

<u>3 optimization methods:</u>

- **marginal analysis**
- **linear programming**
- **Incremental profit analysis**

How managers can make a decision in risk – and uncertainty environment?

Unlike short-term decisions, long-term decisions are made under risk and uncertainty

I don't know what events will occur and how they will affect the implementation of the desired result

In conditions of risk and uncertainty typical decision task is quite difficult, because there are many possible outcomes

Solutions matrix

(*Payment matrix*)

Necessary systematization

I wonder, what is it?

An example of solutions matrix				
Goals	The state of the external environment			
	N1	N2	N3	N4
S1	6	6	6	4
S2	25	7	7	8
S3	10	20	7	9

Alternative strategies

Return: Profit, production volume

The state of the economy: growth, stability, recession, depression

<u>This tool:</u>

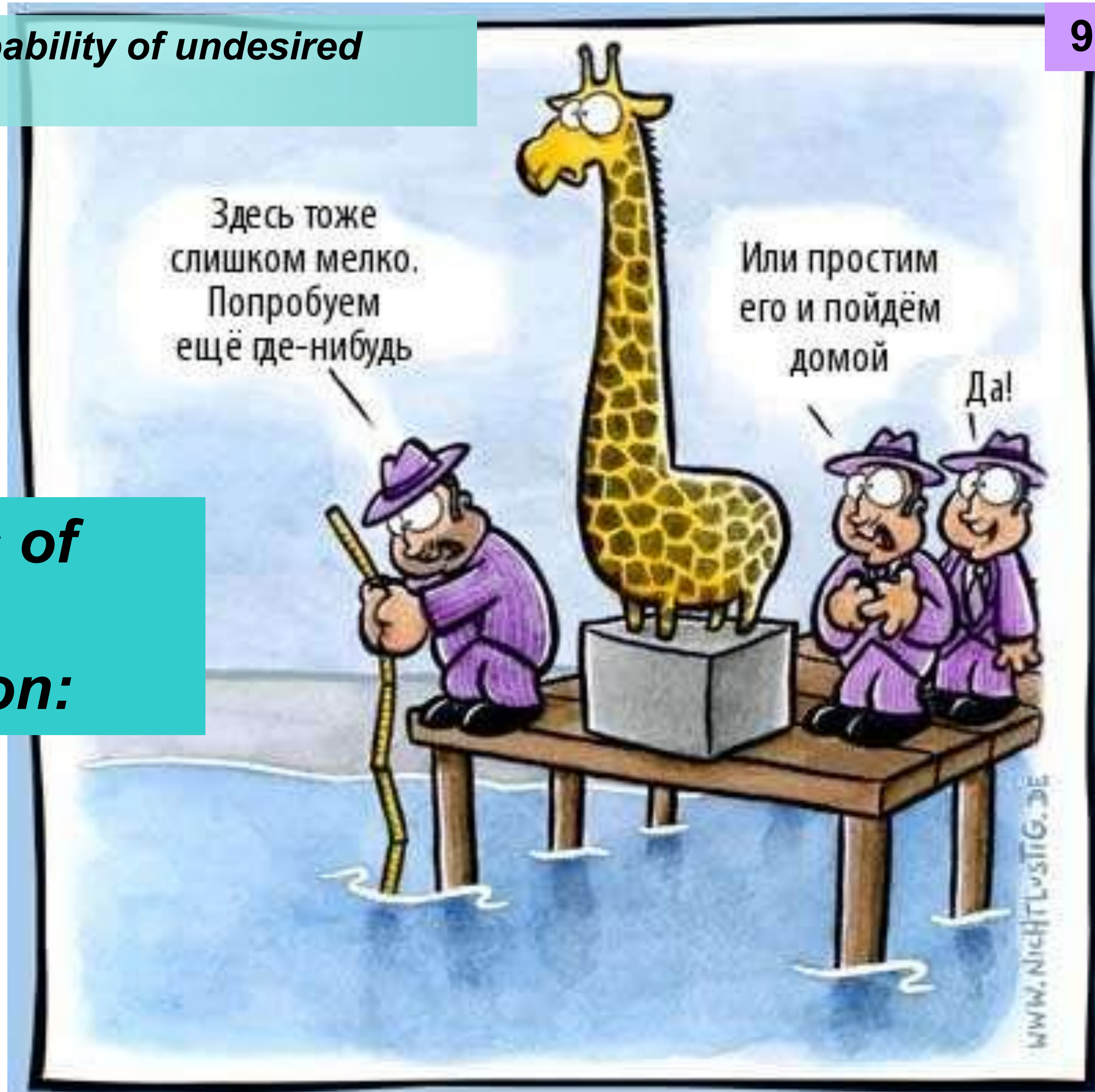
Formalizes the process of decision-making

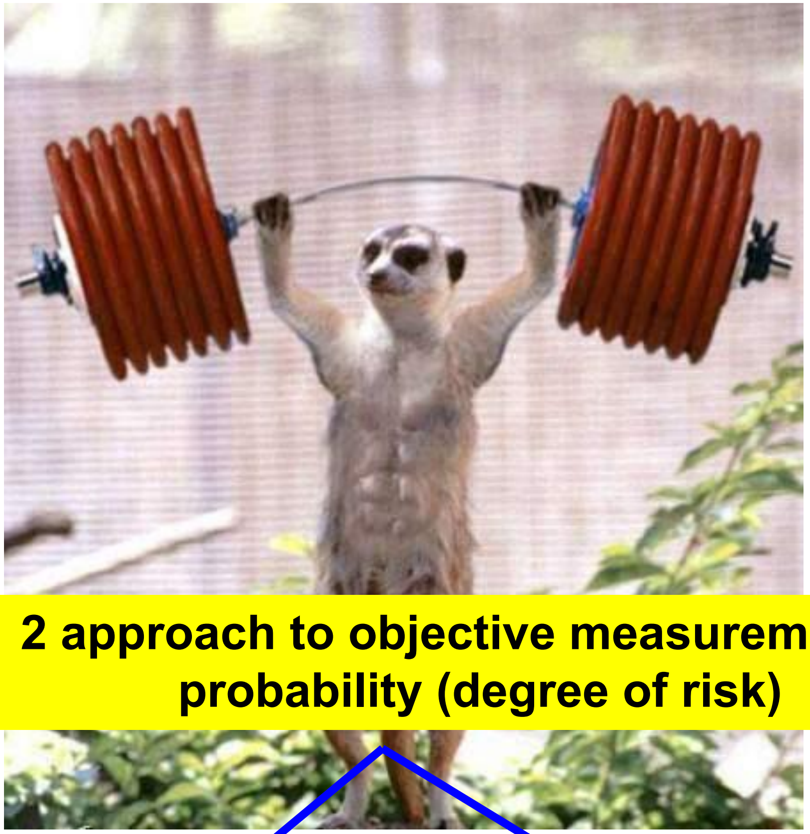
Provides a summary of return for different purposes and state of environment


Decision-making in terms of risk

(Risk – probability of undesired occurense)

Methods of risk evaluation:





2 approach to objective measurement of probability (degree of risk)

A priori (deductive method)

Aposteriori (statistical analysis of empirical data)

A priori
(deductive method)

No experiment and analysis of past experience

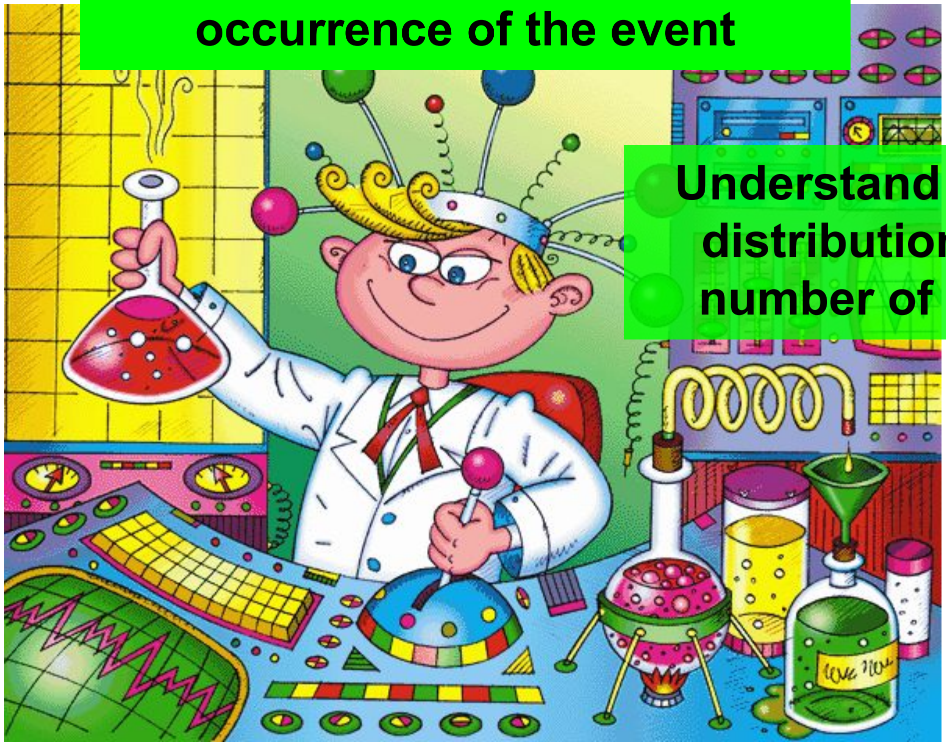
Ex:

characteristics of possible cases are known in advance

Aposteriori (statistical analysis of empirical data)

past experience will continue in the future

Watch the frequency of occurrence of the event

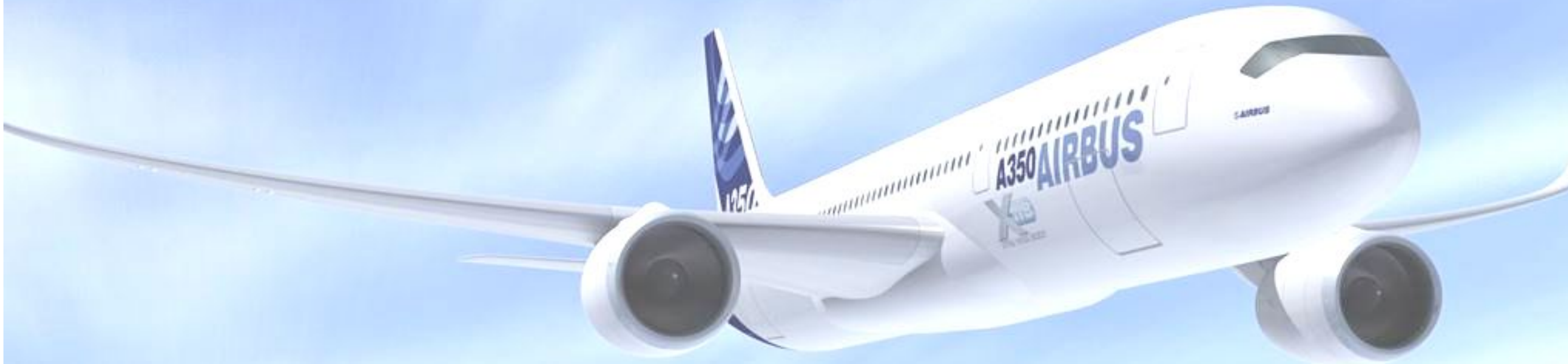


Understand the frequency distribution for the total number of observations

Predict the probability distribution

Frequency distribution can be converted into a probability distribution

If a certain load factor appeared 20 times for 50 flights, we can say that the probability of this factor during the next flight 20/50 = 40



Determine and minimize the risks inherent to a particular project

One of the methods: the calculation of the probability distribution of possible outcomes, then the calculation of expected value

Expected value

$$E(X) = P_1X_1 + P_2X_2 + ... + P_nX_n = \sum_{i=1}^{n} P_iX_i$$

X_i - ***Value of i outcome***

P_i - ***Probability of i outcome***

The expected value of the strategy is the weighted average cost, which uses the probability of return as weights

Manager choose strategy with the highest expected value

Decision matrix					
Alternative strategies	**The state of the external environment**				**Expected value**
	N1 P=0,20	N2 P=0,65	N3 P=0,10	N4 P=0,05	**E(S)**
S1	6	6	6	4	**5,90**
S2	25	7	7	-15	**9,50**
S3	20	20	7	-1	**17,65**
S4	19	16	9	-2	**15,00**
S5	20	15	15	-3	**15,10**
Optimum strategy					

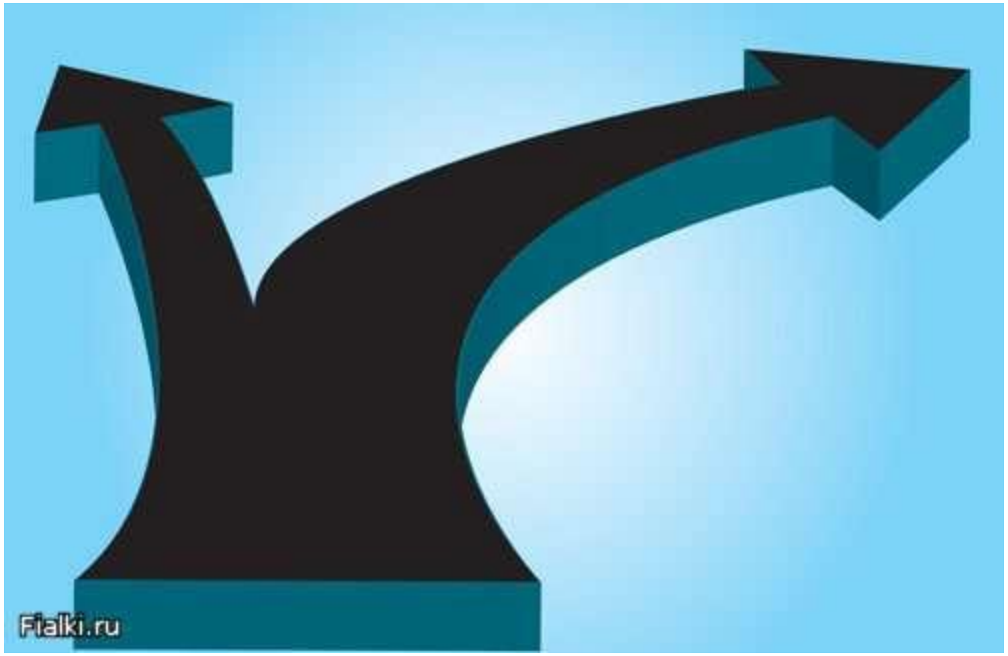
Suppose that expected value of alternatives strategies are equal

Decision matrix			
Alternative strategies	The state of the external envir		
	N1 P=0,25	N2 P=0,50	N3 P=0,25
S1	20	10	20
S2	40	10	0
S3	10	10	10

How can we choose between S1 and S2?

New criteria – <u>degree of risk</u>

May be determined as deviation scope of probable outcome from expected value



Decision matrix				
Alternative strategies	The state of the external environment			
	N1 P=0,25	N2 P=0,50	N3 P=0,25	Expected value E(S)
S1	20	10	20	15
S2	40	10	0	15

By intuition we feel that the further away from the average value will be the actual outcome, the riskier the project will be

↓

One way of calculating risk - calculation of swing (amplitude)

swing (amplitude)

- the difference between the extreme values of probable outcomes

Decision matrix				
Alternative strategies	**The state of the external environment**			
	N1 P=0,25	N2 P=0,50	N3 P=0,25	Предполагаемая стоимость E(S)
S1	20	10	20	15
S2	40	10	0	15

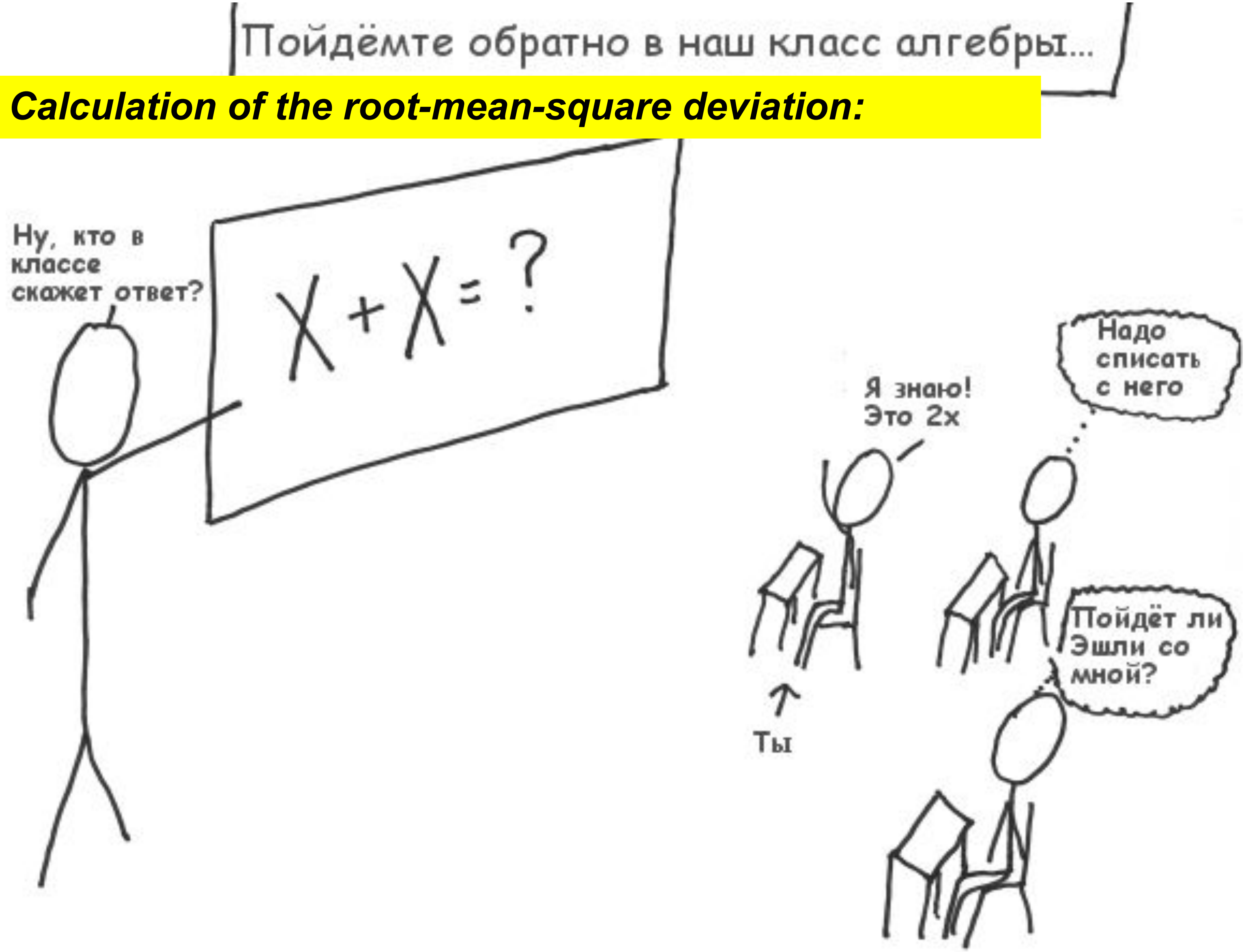
Swing for S1 – 10, for S2 – 40.

root-mean-square deviation

$$\sigma$$

The higher root-mean-square deviation - the higher risk

Calculation of the root-mean-square deviation:



Вычисление среднего квадратичного отклонения

Таблица 4.4

Вычисление среднего квадратичного отклонения

Стратегия	$(X_i - \mu)$	$(X_i - \mu)^2$	P_i	$(X_i - \mu)^2 P_i$	
S_1	5	25	0,25	6,25	
	−5	25	0,50	12,50	
	5	25	0,25	6,25	
				$\sigma_1^2 = 25{,}00$	$\sigma_1 = 5$
S_2	25	625	0,25	156,25	
	−5	25	0,50	12,50	
	−15	225	0,25	56,25	
				$\sigma_2^2 = 225{,}00$	$\sigma_2 = 15$

S2 is 3 times more risky than S1