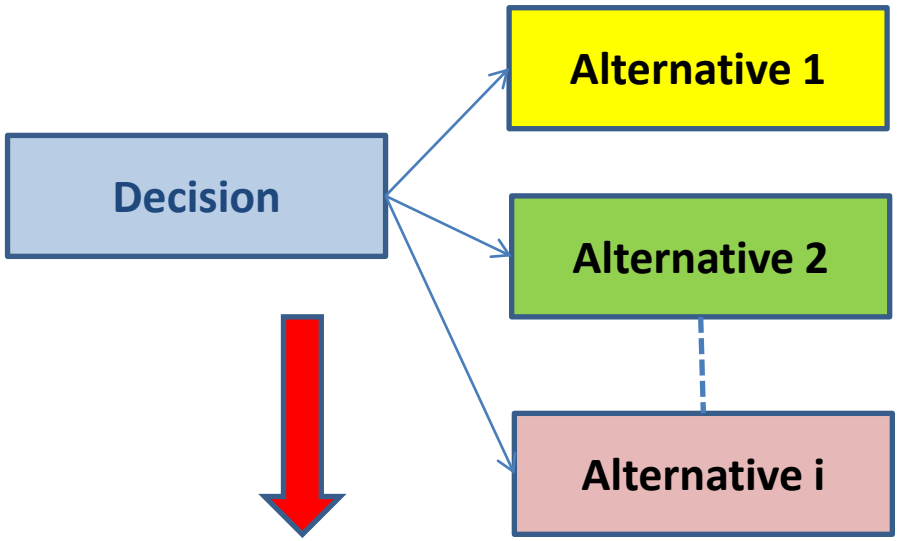
Hurwitz score related decision making methods

Skorkovský
Department of business economy

Uncertainty-Risk

Although the possible returns of the investment are beyond the control of the decision maker, the decision maker might or might not be able or willing to assign probabilities to them. If no probabilities are assigned to the possible consequences, then the decision situation is called "*decision under uncertainty*". If probabilities are assigned then the situation is called "*decision under risk*". This is a basic distinction in decision theory, and different analyses are in order.

First approach



A/O	O1	O2	O3	O4	O5
A1	po11	po12	po13	po14	po15
A2	po21	po22	po23	po24	po25
A3	po31	po32	po33	po34	po35
A4	po41	po42	po43	po44	po45

Decision Table (*payoff table*)

Where : A=Alternative(action); O=Outcome *(výsledek, závěr)* ; po=payoff *(přínos, prospěch)*

A=(A1,A2,…Ai) = inventory of viable options=vector, **O**=(O1,O2,…Ok)= outcome vector

Chosen criteria I

- MaxiMax
  - MaxiMax is the rule for the optimist. A slogan for MaxiMax might be "best of the best" - a decision maker considers the best possible outcome for each course of action, and chooses the course of action that corresponds to the best of the best possible outcomes

Example of the decision table I (best of the vector {800,400,200,100} is 800 !!

Choices	Profit		
	Strong market	Fair market	Poor market
invest $8000	**$800**	$200	-$400
invest $4000	**$400**	$100	-$200
invest $2000	**$200**	$50	-$100
invest $1000	**$100**	$25	-$50

Example II

MaxiMax Payoff

Select the alternative which results in the maximum of maximum payoffs; **an optimistic criterion**

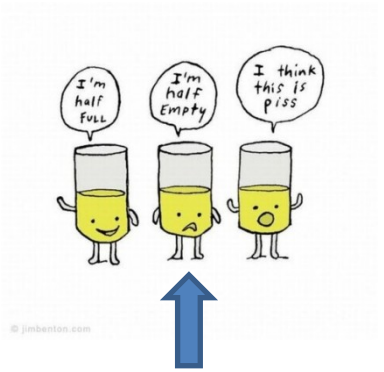
Payoff Table

	Outcomes			
Alternatives	**O1**	**O2**	**O3**	Maximum Payoff
A	$1,000	$1,000	$1,000	$1,000
B	**$10,000**	-$7,000	$500	**$10,000**
C	$5,000	$0	$800	$5,000
D	$8,000	-$2,000	$700	$8,000

B > D > C > A

Alternatives (invested amount, expectant spouse inheritance, type of the car,..)

Chosen criteria II



- MaxiMin
  - The MaxiMin decision rule is used by a pessimistic decision maker who wants to make a **conservative decision**. Basically, the decision rule is to consider the worst consequence of each possible course of action and chooses the one that has the **least worst consequence** (in our case= -50). So it is better to invest nothing !!!!

Choices	Profit		
	Strong market	Fair market	Poor market
invest $8000	$800	$200	-$400
invest $4000	$400	$100	-$200
invest $2000	$200	$50	-$100
invest $1000	$100	$25	**-$50**

Example II

MaxiMin Payoff

Select the alternative which results in the maximum of minimum payoffs; a pessimistic criterion

Payoff Table

Alternatives	Outcomes O1	O2	O3	Minimum Payoff
A	$1,000	$1,000	$1,000	**$1,000**
B	$10,000	-$7,000	$500	-$7,000
C	$5,000	$0	$800	$0
D	$8,000	-$2,000	$700	-$2,000

A > C > D > B

Decision Strategy I

Hurwitz criterion allows to choose strategies depending on inclination to risk

A/O	O1	O2	O3	O4	O5
A1	po11	po12	po13	po14	po15
A2	po21	po22	po23	po24	po25
A3	po31	po32	po33	po34	po35
A4	po41	po42	po43	po44	po45

Where : **A**=alternative(action, strategy); **O**=Outcome; po=payoff (benefit, profit); winning score, **A**=(A1,A2,...Ai) = inventory of viable options=vector,
O=(O1,O2,...Ok)= outcome vector,
α = risk parameter (if 100 % optimistic ->**α=1**, if 100 % pesimistic -> **α=0**)

$$P^* = \max\{\alpha * \max(pi,Ok)\} + (1 - \alpha) * \min(pi,Ok)\}$$

Example on the next slide

Decision Strategy II

A/O	O1	O2	O3	a	b
A1	1	5	7	7	1
A2	3	2	6	6	2
A3	5	4	3	5	3

Where **ai** = max (pi,Ok) and **bi**= min(pi,Ok)

p* =max {α * ai+(1 — α) * bi } - calculation of payoff (benefit, profit)

E.g. If α = 0,8, and max ai=7 and min bi=1 then
p* = max { 5,8; 5,2 ; 4,6 } = 5,8

Where 5,8=7*0,8+(1-0,8)*1=5,6+0,2; 5,2=6*0,8+(1-0,8)*2,…….

Thanks for Your attention