Deriving price from the demand curves – problem for practice

1. Prague wants to construct a new tunnel Bianca, which will improve the traffic connection between two districts. Ne tunnel will decrease the costs per trip between the districts by 50 CZK for saved fuel, by 150 CZK for saved time, and moreover drivers will be much less stressed (without appraisal). On the other hand the drivers would pay a 20 CZK toll per each trip. Assume that the fee would become revenue in the municipal budget and the drivers would only use the tunnel. Currently there are 2 million trips between the districts per year, and with the tunnel it is estimated to increase up to 2.6 million. Calculate the total benefit of building this new tunnel for the city and for the drivers?

   (*Solution: annual benefit for the drivers is 414 mil. CZK, revenue for Prague is 52 mil. CZK*)

WTP – problem for practice

1. Small community in town is deciding between keeping the current playground for children, and building new parking lots. Help them decide if social benefits of the playground have been evaluated by experts as 7.5 million CZK (a big one). In case of new parking lot, based on the questionnaire the demand for the first 30 parking lots is $d_1 = 1000 * (200 - 4q)$, for the rest $d_2 = 1000 * (110 - q)$. Calculate social benefits of the new parking lot using WTP method (do not consider investment costs).

   (*Solution: Area under the pseudo-demand curve for parking lots is only 7.4 million CZK*)

Hedonic method – problem for practice

1. You are supposed to calculate (using hedonic method) the value of negative impact of building a new road on the houses along it. There are 50 houses in total. Price of the house is estimated as:

   $$p_i = \alpha + \beta(room) + \gamma(noise) + \delta(x_i) + \varepsilon_i$$

   where p_i means estimates price of the house, $room$ amount of rooms in the house, $noise$ level of noise from the road, and x_i some other house characteristics. Coefficients have values of $\alpha = 80$, $\beta = 30$, $\gamma = -90$ a $\delta = 1$. New road will increase noise level from originally 0.1 to 0.6.

   (*Solution: Value of the houses will decrease in total by* $50 * (-45) = -2250$)

TCM – problem for practice

1. Somewhere in deep woods there is an old ruin of the fortress. Local authority is deciding, whether to level it down and build there a wind power plant that would bring revenue of 10 million CZK per year. Based on the data below, using TCM estimate social benefits of the fortress and decide whether to keep the ruin or build a plant. Assume discontinuous changes in demand for visits and no visit from additional zones. Also assume the visit are one purpose only, there is nothing of interest anywhere around.

Zone	Distance	Population	Probability of visit per year	Total costs per visit
1	10	10 000	15%	50 CZK
2	30	100 000	7%	170 CZK
3	70	300 000	3%	400 CZK
4	150	1 000 000	0.5%	1 000 CZK

(*Solution: Economic benefits of the ruin are 9 865 000 CZK per year, what is less than revenues from wind power plant – authority should thus build a new power plant*)

Dominated and non-dominated variants – problems for practice

1. Choose which variants are non-dominated and dominated (and by which ones).

	k_1 (min)	k_2 (max)	k_3 (max)
Variant 1	50	54	24
Variant 2	28	72	39
Variant 3	21	77	51

(*Solution: Non-dominated variant is 3; var 1 is dominated by 2 and 3; var 2 is dominated by 3*)

2. Choose which variants are non-dominated and dominated (and by which ones). Determine ideal and basal variant and full solution.
*hint: you can try to use Excel add-in SANNA from prof. Jablonský from PSE

	k_1 (min)	k_2 (max)	k_3 (min)	k_4 (max)	k_5 (min)
Variant 1	48	64	84	64	18
Variant 2	24	82	6	105	15
Variant 3	26	88	146	101	7
Variant 4	33	67	22	56	20
Variant 5	47	60	126	70	18
Variant 6	28	88	166	75	19

(*Solution: Non-dominated variants are 2 and 3 (full solution); variants 1, 4, 5 are domin by 2, variant 6 is domin by 3; basal variant has values 48, 60, 166, 56, 20; ideal 24, 88, 6, 105, 7*)

Transformation of minimizing criteria to maximizing, normalizing – problems for practice

1. Transform the following criteria to maximizing.

	k_1 (min)	k_2 (max)	k_3 (min)	k_4 (max)	k_5 (min)
Variant 1	48	64	84	64	18
Variant 2	24	82	6	105	15
Variant 3	26	88	146	101	7
Variant 4	33	67	22	56	20
Variant 5	47	60	126	70	18
Variant 6	28	88	166	75	19

(*Solution: for transforming min criterion values to max values use y(max) = B(min) – y(min)*)

	T-k_1 (min)	k_2 (max)	T-k_3 (min)	k_4 (max)	T-k_5 (min)
Variant 1	0	64	82	64	2
Variant 2	24	82	160	105	5
Variant 3	22	88	20	101	13
Variant 4	15	67	144	56	0
Variant 5	1	60	40	70	2
Variant 6	20	88	0	75	1

2. Transform the following matrix of parameters to the normalized values.

	k_1 (min)	k_2 (min)	k_3 (max)
Variant 1	50	54	24
Variant 2	28	72	39
Variant 3	21	77	51

(*Solution: we transform max criterion values using (y-B)/(I-B), and min using (B-y)/(B-I)*)

	T-k_1 (min)	T-k_2 (min)	T-k_3 (max)
Variant 1	0	1	0
Variant 2	0.76	0.22	0.56
Variant 3	1	0	1

WSA – problems for practice

1. We have 5 evaluation criteria, that were assigned points based on their importance: k_1) 3, k_2) 6, k_3) 7, k_4) 1, k_5) 5. Calculate weights of these criteria (for possible further calculations).

(*Solution: individual weights are calculated as the ratio of k_n from Σ(k_1 ...k_n), thus k_1) 0.136; k_2) 0.273; k_3) 0.318; k_4) 0.045; k_5) 0.227; what sums up as 1.000*)

2. An investor has decided to build a factory and chooses between 4 alternatives. Individual parameters and weights are in the table. Use WSA for evaluation of the variants.

	Investment costs	Running costs	Production of item 1	Production of item 2	Production of item 3
Variant 1	58	9.7	58	58	67
Variant 2	55	5.4	59	69	121
Variant 3	54	9.2	63	50	31
Variant 4	69	11.8	43	90	190
weights	8%	12%	15%	22%	43%

(*Solution: 1) 35.2%; 2) 66.3%; 3) 27.9%; 4) 65.0%*)

3. An investor has again decided to build a factory and chooses between 3 alternatives. Individual parameters and weights are in the table. Use WSA for evaluation of the variants.

	Investment costs	Running costs	Production of item 1	Production of item 2	Production of item 3	Negatíva voči okoliu
Variant 1	46	5.9	68	57	122	5
Variant 2	31	8.4	61	92	81	6
Variant 3	55	10.3	88	111	144	14
weights	5	4	8	11	14	12

(*Solution: 1) 53.8%; 2) 45.4%; 3) 61.1%*)

Lexicographic method – problem for practice

1. A family wants to buy a new car. They have preliminary chosen 5 models. Use lexicographic method, which models should be considered for further decision.

	Price	Trunk size	Power	Fuel cons.	Safety	Looks
A	488	430	105	6.9	10	6
B	416	401	102	5.1	8	8
C	694	555	108	7.2	10	10
D	449	439	93	6.2	6	7
E	580	445	108	5.6	10	5
Criterion preference	1.	3.	5.	4.	2.	6.
Limit	≤600	≥400	≥100	≤7,0	≥8	≥6

(*Solution: A family would consider models A, B for further decision making*)

Public procurement evaluation – problems for practice

1. Municipality wants to purchase a new lift as a public procurement. Rank the bids.

	Price (mil. CZK)	Delivery (weeks)	Guarantee (months)	Response to problem (hours)	Aesthetics (0-5 points scale)
OTIS	1.95	9	59	4	4
KONE	1.51	12	55	7	1
SCHINDLER	1.66	11	65	5	4
Weights	*67*	*15*	*20*	*29*	*18*

(*Solution: SCHINDLER 87.8%; OTIS 86.2%; KONE 77.4%*)

2. Rank bind in a public procurement evaluation. How can you change k_2 level to make the last bid become the best? And how can you change k_3 level in case of the second best bid?

	k_1 (min)	k_2 (max)	k_3 (min)
Bid 1	22	17	22
Bid 2	8	39	25
Bid 3	22	40	20
Bid 4	14	29	20
Weights	50%	15%	35%

(*Solution: ranks of bids – 1) 56.4%; 2) 92.6%; 3) 68.2%; 74.4%; changing parameter k_2 cannot make the worst offer becoming the best; to make 4) better than 2) by changing k_3 the 4) must lower the acquired 28% of 2) in k_3 to less than 9.82% – as it is a minimizing criterion, we need to decrease the value of parameter k_3 in case of bid 4) to 20/(28/9.82) = 7.014 or less in order to make 4)get better score than 2)*)