EXAMINATION: MARKETING MODELS & ANALYSIS WS 2010/11
EXAMINER: PROF. DR. B. ERICHSON, NUMBER OF LECTURE: 20205

You are allowed to use a non-programmable pocket calculator without communication functions.
The answers to all questions should be made in one language, please use English or German. Use the space under the question for your answer!
All of the 7 exam questions must be answered (estimated time for each question is given). The examination has 6 pages.
Instead of a decimal "." point in numbers we use a comma "," here!

Question 1: Basics **(8 Min.)**

a) Name two purposes of models!
b) An important type of a model (for business as well as for economics) is a Market Response Function (MRF).
   b1) Give two examples of dependent variables in MRFs!
   b2) Independent variables in MRFs can be divided into controllable and uncontrollable variables. Give two examples of both!
c) What advantages arise from using models for decision making instead of "gut feelings"?

Question 2. Methodology and Estimation **(10 Min.)**

The empirical application of mathematical models requires calibration, i.e. fitting a model to reality by estimation of the model parameters on the basis of empirical data.

a	Which estimation methods (principles) can be used for the calibration (estimation) of models?
b	Nonlinear models are classified into **intrinsically linear models** and **intrinsically non-linear models**. Which of the following models are intrinsically linear? Mark them with a cross below. b1) $Y = \alpha + \beta \cdot \sqrt{X} + u$ b2) $Y = \alpha \cdot X^{\beta} + u$ b3) $Y = \alpha \cdot X^{\beta} \cdot u$ b4) $Y = \alpha + \beta \cdot X^{\gamma} + u$ b5) $Y = 1 - \alpha \cdot e^{-\beta \cdot X + u}$ b6) $Y = M - \alpha \cdot e^{-\beta \cdot X} + u$ O b1 O b2 O b3 O b4 O b5 O b6
c	For estimation it is important to distinguish between linearity in variables (regressors) and linearity in parameters. Which type of **linearity** is required for the application of linear regression analysis?
e	Try to linearize the following logistic model for estimation by linear regression! $Y = \frac{100}{1 + e^{\alpha + \beta \cdot X + u}} [\%]$

Question 3. Model Estimation with Excel (10 Min.)

Mr. Sugarberg, the product-manager of the company Face& Book SE, wants to support his decisions on price and advertising by marketing engineering with the help of MS Excel.
For this purpose he has collected data on sales (Y), price (P) and advertising (W) and specified the following **Demand Model** (market-response function):

$$Y = a + b_1 \cdot P + b_2 \cdot \sqrt{W} + u$$

The spreadsheet below shows the data of Mr. Otto and procedures for estimation and decision.

Mr. Sugarbergs´s Excel Spreadsheet:

	A	B	C	D	E	F	G	H	I
1									
2	**Demand Model:** $\hat{Y} = a + b_1 \cdot P + b_2 \cdot \sqrt{W}$								
3								Parameter:	a = 19,400
4	A. Data and Estimation								b1 = -2,000
5									b2 = 0,500
6		Sales	Price	Avertising					
7		Y	P	W	$\hat{Y}$	$(Y-\hat{Y})^2$		Total Variation	
8		12	4	1	11,90	0,01			6,76
9		8	6	1	7,90	0,01			1,96
10		13	4	4	12,40	0,36			12,96
11		7	7	4	6,40	0,36			5,76
12		10	6	4	8,40	2,56			0,36
13		9	5	4	10,40	1,96			0,16
14		11	5	9	10,90	0,01			2,56
15		7	6	4	8,40	1,96			5,76
16		11	5	9	10,90	0,01			2,56
17		6	7	4	6,40	0,16			11,56
18	Mean:	9,4	5,50	4,40	SSR =	7,40		SST =	50,4
19									
20								R-Square =	0,853
21	B. Decision								
22									
23		Revenue		R =	p * y				
24		Cost		C =	Cf + k*y+w		with	Cf =	8,00
25		Profit		Profit =	R - C			k =	3,00
26									
27		Calculation:							
28		p	w	y	R	C			Profit
29		0,00	0,00	19,40	0,0	66,2			-66,2
30									
31									
32									
33									
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47									

Solver Parameters

Set Target Cell: | Solve

Equal To: Max Min Value of: 0 | Close

By Changing Cells:

Guess | Options

Subject to the Constraints:

Add | Change | Delete | Reset All | Help

a	Which **estimation principle** uses Mr. Sugarberg for the calibration of his model?
b	Mr. Sugarberg wants to use the Excel Solver for estimating the parameters of his model. Please help him to specify the parameters in the Solver window! b1) **target cell** (objective function) b2) **target value** (Min or Max) b3) **changing cells** (parameters to be estimated)
c	The spreadsheet below already shows the result of the estimation. Please write down the **estimated function**!
d	Judge the goodness of fit of the estimated function and give the **percentage of explained variation**!

Question 4. Marketing Decision Making with Excel **(6 Min.)**

Mr. Sugarberg wants to use the spreadsheet above also to find the price and advertising spending that maximize his profit. His target function is $\text{Profit} = R - C = (p-k)\cdot y(p,w) - C_f - w$

a	Please help Mr. Sugarberg! Specify in the Solver window b1) the **target cell** (objective function) b2) the **target value** (Min or Max) b3) the **changing cells** (parameters to be estimated)
b	After clicking the solve button, alas Mr. Sugarberg ´s gets a degenerated solution. What can he do (name two possibilities)?

Question 5. Advertising Decision without Excel (10 Min.)

After finding the optimum price and advertising budget with the help of Excel alas Mr. Sugarberg´s PC breaks down. Mr. Sugarberg can only remember the optimum price: $p^* = 4{,}99$.

By knowing this he can simplify his demand function to:

$$\hat{Y} = 6{,}18 + 0{,}50 \cdot \sqrt{W}$$

Mr. Sugarberg remembers that in ancient times managers used to determine the optimum advertising budget without a computer by use of an obscure method called "differential calculus". Alas he does not know how this method works. Please help him!

a	Determine the optimum advertising budget w*! Given: Demand $y = 6{,}18 + 0{,}50 \cdot \sqrt{w}$, Price $p^* = 4{,}99$ Cost $C = C_f + k \cdot y = 8{,}0 + 3{,}0y$
b	How will w* change, if Mr. Sugarberg rises his price to p = 7,00? Give the value of w*!
c	How will Mr. Sugarberg ´s profit change, if he rises his price to p = 7,00? Will it rise, shrink or stay equal?
d	How will p* change, if Mr. Sugarberg spends more for than w* for advertising? Will it rise, shrink or stay equal?

Question 6. Dynamic Advertising Models (6 Min.)

The MMM company estimated the following advertising response function:

$$y_t = 2000 + 500 \cdot \ln(w_t) + 0{,}6 \cdot y_{t-1}$$

with y_t = sales in period t

w_t = advertising spending in period t

Aassume: p = 5 price per unit

k = 3 variable cost per unit

a	Which type of model is used here?
b	What is the optimal advertising budget, if you take a short term perspective?
c	What is the optimal advertising budget, if you take a long term perspective?

Question 7: Linear Regression Analysis

(10 Min.)

The cat food producer WhisCats has performed a regression analysis of sales on his marketing variables by using SPSS. The output is shown below:

	Sum of Squares	Durbin-Watson-Statistic:
Regression	1.204	1,9
Residuals	1.143	
Total	2.347	

predictors: events_with_Cats, price_per_can, promotion;
dependent variable: Sales

coefficients	unstandardized coefficients	standardized coefficients		
	B	**Beta**	**t**	**Sign.**
(constant)	6,53			
price_per_can	-,27	-,17	-1,46	,152
promotion	,92	,36	2,76	,008
Events_with_Cats	,94	,35	2,74	,009

a	Write down the **estimated function**!
b	Judge the global **goodness of fit** of this function by computing R^2!
c	Judge the **importance** of variables (regressors) and **significance** of their coefficients! (assume $\alpha = 5\%$)
e	Interpret the **Durbin/Watson Statistic**!

Good Luck!