Paper 7

E(Z) = Expected Profit
E(Q) = Expected Sales
P = Price
V = Variable Cost
F = Fixed Cost

E(Z) = E(Q)(P-V) - F

- Assumptions: Sales volume mean = 5,000 and standard deviation = 400, per-unit selling-price = 3,000, fixed cost = 5,800,000 and variable cost per unit = 1,750.
- What is: Expected profit, standard deviation of profit, prob. of at least breaking even, prob. of profits greater than 200,000, prob. of loss greater than -300,000
- Expectation and standard deviation of profit, if all variable are stochastic (p. 924)

Expected Sales
Mean = 5000
Stdd. = 400
Fixed cost = 5.800
Variable Cost per Unit = 1.750
P = 3000

Standard deviation of profit

Stdd * (P - V) = 400 * (3000-1750) = 500.000

Probability of at least break even

E(Z) = E(Q) * (3000 - 1750) - 5.800.000

Breakevenquantity (Q) = F / (P-V)

5.800.000 / (3000 - 1750) = 4640

X = (Actual Sales - Mean Sales) / Deviation

We assume Actual Sales = Q, to calculate the probability of the case having more than the break even

X = (4640 - 5000) / 400 = -0,9

P(X) = 0,18
1 - P(X) = 0,8160 → achtung: falsch… war aber die Lösung in der VO und genauso im Paper!
→ hat er aber in der VO dazu gesagt, dass es falsch ist im Paper

→ F(-0,9)= 1-F(0,9) = 1-0.81594 = 0.18406
F(-X) = 1 - F(X) → wegen Symmetrieeigenschaft der NV
Lookup Table here:
https://de.wikipedia.org/wiki/Standardnormalverteilungstabelle

Probability profit is greater than 200.000

E(Z) = E(Q) * (3000 - 1750) - 5.800.000

Breakevenquantity (Q) = F / (P-V)

5.800.000 / (3000 - 1750) = 4640

Profit per sales after break even

Desired Profit (D) / (P-V) = Sales needed after break even

200.000 / (3000 - 1750) = 160

Actual Sales = Break Even + Sales needed after break even 4640 + 160 = 4800

Leichterer Lösungsweg:
200 000 = Q * (P - V) - F
6 000 000 / 1250 = Q
Q=4800

X = (Actual Sales - Mean Sales) / Deviation
(4800 - 5000) / 400 = -0.5

(1 - P(-0,5) = 0,69146) → achtung: falsch

P(-0.5) = 1 - P(0.5) = 0.30854 → siehe Break Even Berechnung

Sorry but isn't that the probability that your profit won't be greater than 200000?

300.000 Lost Probability

E(Z) = E(Q) * (3000 - 1750) - 5.800.000

Breakevenquantity (Q) = F / (P-V)

5.800.000 / (3000 - 1750) = 4640

Things I can not sell= 300.000 / (3000 - 1750) = 240

Actual sales = Break Even - things I can not sell= 4400

X = (Actual Sales - Mean Sales) / Deviation
(4400 - 5000) / 400 = -1,5

→ -300 000 = Q * (P - V) - F
Q=4400
Z=(4400-5000)/400 = -1.5
P(-1.5) = 1-P(1.5) = 0.06681
P(X) = P(-1,5) = 0,066807

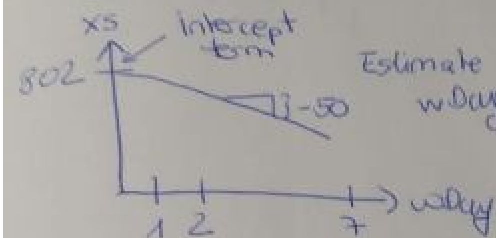
Difference between P(x>y) and P(x<y)
Can someone explain/show which way around means what?
Eg. loss greater 300.000 vs win greater 300.000

Paper 8

Single numerical variable regression model

IT-Based 14.12.2018

Table 4 in Article 8



Estimate wDay $y = kx + d$

$XS = 802 - 50 \cdot wday$

1,2,...,7

Single categorical factor regression model

asfactor(wDay)

Monday, Tuesday, ..., Friday

14.12. 0 0 0 0 1 0 0

1 to Friday

Dummy variable (boolean with logic)

Table 5 changed to

ABC ~ 0 + as.factor(wDay) — no intercept term anymore

=> regression without intercept

wDay(1) 821.7

wDay(2) -113. +821.7

Table 4: ABC sales volumes – Single variable linear model (svlm)

```
> xSD01ABC.svlm <- NULL             # Single variable linear model (svlm)
> xSD01ABC.svlm <- lm(ABC~wDay,xSD01Ext.xts)
> summary(xSD01ABC.svlm)
Call:
lm(formula = ABC ~ wDay, data = xSD01Ext.xts)
Residuals:
    Min      1Q  Median      3Q     Max
-285.28 -138.50  -41.32  126.29  492.94
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  802.001     18.156  44.172   <2e-16 ***
wDay         -50.055      5.466  -9.157   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 176.7 on 521 degrees of freedom
Multiple R-squared:  0.1386,  Adjusted R-squared:  0.137
F-statistic: 83.85 on 1 and 521 DF,  p-value: < 2.2e-16
```

Table 5: ABC sales volumes – Single factor (multinomial) linear model (sflm)

```
> xSD01ABC.sflm <- NULL               # Single factor linear model (sflm)
> xSD01ABC.sflm <- lm(ABC~as.factor(wDay),xSD01Ext.xts)
> summary(xSD01ABC.sflm)
Call:
lm(formula = ABC ~ as.factor(wDay), data = xSD01Ext.xts)
Residuals:
    Min      1Q  Median      3Q     Max
-301.14 -133.00  -25.36  122.85  423.19
Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)        821.70      15.55  52.844  < 2e-16 ***
as.factor(wDay)2  -113.65      21.99  -5.168 3.38e-07 ***
as.factor(wDay)3  -301.69      21.94 -13.752  < 2e-16 ***
as.factor(wDay)4  -250.92      21.94 -11.438  < 2e-16 ***
as.factor(wDay)5  -182.33      21.94  -8.311 8.38e-16 ***
```

Result after adding 0+as.factor(wDay)

Coefficients:

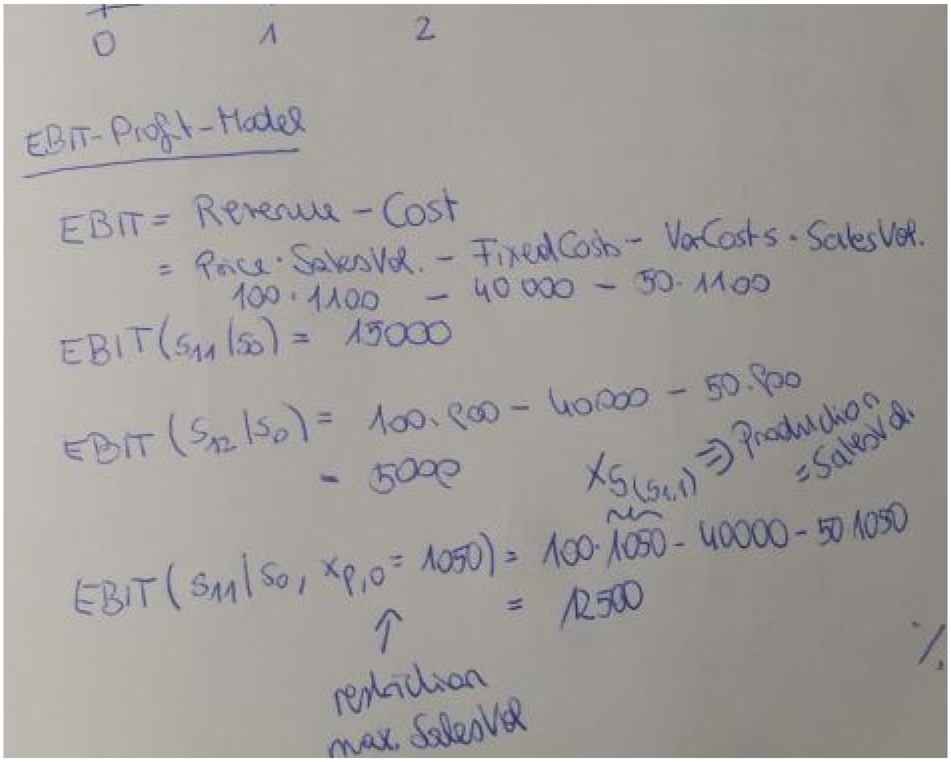
	Estimate	Std. Error	t value	Pr(>|t|)
as.factor(wDay)1	821.70	15.55	52.84	<2e-16 ***
as.factor(wDay)2	708.05	15.55	45.53	<2e-16 ***
as.factor(wDay)3	520.01	15.48	33.60	<2e-16 ***
as.factor(wDay)4	570.77	15.48	36.88	<2e-16 ***
as.factor(wDay)5	639.37	15.48	41.31	<2e-16 ***

Can someone explain what we should learn from this?

Paper 9

Case: Plannig of Stochastic Optimal Production Volumes

- You as management controller support the production managers in planning
- The production management has to set the production volumes for the following two periods. In the second period two different state can be distinguished according to the sales realizations in the first period.
- What are the optimal production volumes for the two periods, if the expected EBIT profit has to be maximized and the following information is available
    - Capacity limitations only allow the production of either 950 or 1.050 units
    - Last period's demand was 1.000 units; in each future period the demand can increase with 50 % probability by 10 % or decrease with 50 % probability by 10 %
    - Currently no units are on stock (empty inventory)
    - Sales price: 100; variable unit cost: 50; periodic fixed cost: 40.000; storage cost/unit: 5



EBIT = Earning before interest

EBIT = Revenue - Cost
Price * Sales - Fixed Costs - Variable Costs * Sales

S(S11|S0)= 15.000

EBIT(S12|S0) = 100 * 900 - 40.000 - 50*900 = 5000

EBIT ($S_{2,3}$ | S_0, $x_{p,0}$ = 1050) =
$x_{p,1}$ = 1050

$S_{2,3}$ → = 990 · (100 − 50) − 40000 −
5 · (150 + 60) = **8.450**

← Costs /unit für storage

↓ Differenz 1050 − 900 → $S_{1,2}$

↘ Differenz 1050 − 990 → $S_{2,3}$

man geht immer davon aus, dass 1050 in jeder Periode hergestellt werden

ACC Model

Productive Cost

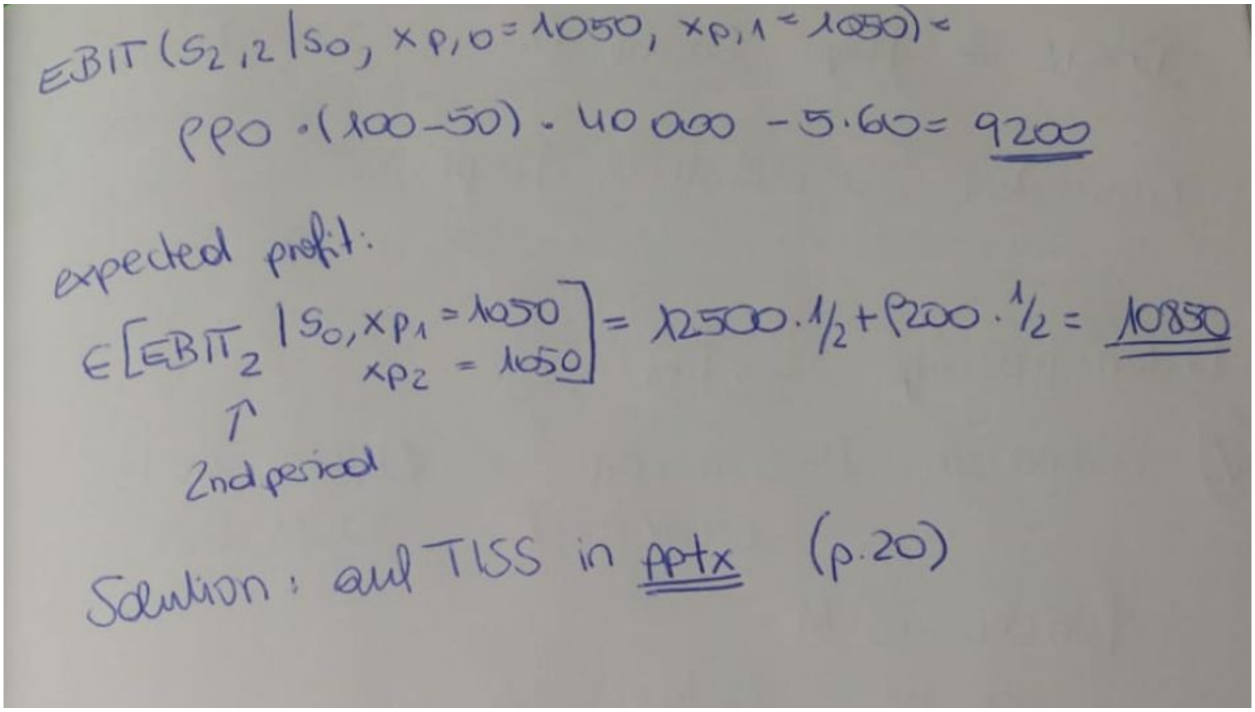
1050·50 = 52.500	150·50 = 7500

45000 Costs of goods ~~solved~~ sold "COGS"

(Balance Sheet)

stock of Products

150·50 = 7500	



In which pptx? → “CVPbasedProductionPlanning1812.pdf” (p. 25 contains all steps) -> thanks :)

Paper 10

CPI (Cost Performance Index) = < 1 (Over-Budget, ich bin übers budget)
SPI (Schedule Performance Index) < 1 (Over-Time, ich bin hinten nach)
SV (Schedule Variance) < 0 (Over-Time)
CV (Cost Variance) < 0 (Over-Budget)
BCWP = EV (Budgeted Cost for Work Performed = Für die tatsächlich gemachte arbeit, wie viel kosten wären im Plan → berechnet nach der erledigten Arbeit und den geplanten Kosten)
ACWP = AC (Actual Costs of Work Performed = Wieviel hat die tatsächlich gemachte Arbeit gekostet)
BCWS = (Budgeted Cost of Work Scheduled = Wie hoch waren die geplanten kosten zum Stichtag)

SPI = BCWP / BCWS
CPI = BCWP / ACWP

SV = BCWP - BCWS
CV = BCWP - ACWP

Group work: Controlling projects under uncertainty

- You – as project manager at IBM – are responsible for achieving the time and cost budgets set for the new management control project. For that purpose you identified the critical path along the working packages A1 (4), A4 (3) and A9 (3), where the entry in parenthesis indicates the expected duration in months. According to the PERT scheduling methodology you calculate the planned project duration along the critical path.

Now at runtime of the project execution you observe that the first working package took one month longer than scheduled. Based on that information calculate the conditional forecast for the overall project duration by using the additive model and subtract the originally planned project duration from this forecast to calculate the plan/forecast deviation. If the deviation is larger than 5 % of the planned duration you hire an additional software developer in order to eliminate the existing deviation and to finish to project just in time.

1/10 = 10% deviation

$ACWP = 4$

$BCWP = 0,8 \cdot 4 = 3,2$

$\underline{BCWS = 4}$

$SPI \quad \frac{BCWP}{BCWS} \quad \frac{3,2}{4} = 0,8$

Very helpful:
https://www.youtube.com/watch?v=z7b3SYQuqJM
https://www.youtube.com/watch?v=skb-m8UOKqg

MC Questions

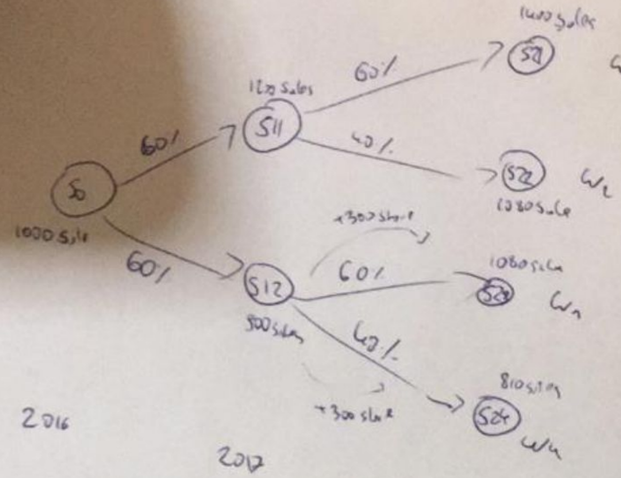
Some MC questions from old semesters that could be useful for this exam:
I am not sure about the answers, so please do not hesitate to update them if you are sure.
You can also add other questions (;

True/False Question	T	F
The backward induction is an important concept in decision theory ⇒ state based control theory	T	
REA is an abbreviation for resources, evaluation and agents		F
Resource-Events-Agents (REA)-based transactions include the concept of duality	T	
PDCA-cycles are the operating principle of the ISO's technical standards		F
Management controls relate to the 2nd line of defence		F
Stochastic control theory deals with finding optimal decisions which relate to single points of time or single periods of time.		F
The state-based control strategy takes the actual realized state information into account	T	
The time-based control strategy takes the actual realized state information into account		F
In the case of an positive EBIT the operating leverage cannot be smaller than 2		F
Standard costs are per-unit costs that can be variable or fixed	T	
The cost volume profit analysis is based upon a quadratic cost function		F
Project control under uncertainty is only valid on the assumption of normally distributed duration of the working packaged.		F
The cost volume profit analysis under uncertainty is introduced by Buzby		F
The EBIT profit measure includes all cost incurred from the production volume	T?	

2) You are the production manager at Strawberry Foundation: Calculate the expected value and the standard deviation of the sum of the EBIT profits for 2017 and 2018, when you decide to produce in the first period 1.100 Strawberry Pi units and in the second period 900 units. In the year 2016 1.000 units were sold and at the beginning of 2017 there are 100 units on stock. The demand for the next years is assumed to follow a binomial process. In each year the demand can increase by 20 % with the probability of 60 % and decrease by 10 % with probability of 40 %. Furthermore you assume the following prices and costs, which all are constant over time: Sales price = 100, fixed costs = 40.000, variable unit cost = 50 and storage cost per unit = 5. (8 Points)

Results: Expected value ....

Standard deviation ....



Sales Price 100
Fixed P 40.000
Var. P. 50
Storage 5

↑20% (60% Prob)
↓10% (40% Prob)

Produce

2016	2017	2018
+100	1100	900
	1200

Sales F V Store

$EBIT(S11|S0, x_1=1100) = 1200 \cdot 100 - 40.000 - 1100 \cdot 50 - 0 \cdot 5 = 25.000$

$EBIT(S12|S0, x_1=1100) = 900 \cdot 100 - 40.000 - 1100 \cdot 50 - 300 \cdot 5 = -6.500$

$EBIT(S21|S11, x_1=1100, x_2=900) = 900 \cdot 100 - 40.000 - 900 \cdot 50 - 0 \cdot 5 = 5000$

$EBIT(S22|S11, x_1=1100, x_2=900) = 900 \cdot 100 - 40.000 - 900 \cdot 50 - 0 \cdot 5 = 5000$

$EBIT(S23|S12, x_1=1100, x_2=900) = 1080 \cdot 100 - 40.000 - 900 \cdot 50 - 120 \cdot 5 = 22400$

$EBIT(24|S12, x_1=1100, x_2=900) = 810 \cdot 100 - 40000 - 900 \cdot 50 - 390 \cdot 5 = -5950$

Σ: 4

$$\text{Mean} = \sum \text{EBIT}/6 = 44950/6 \approx 7492$$

$$\text{Var} = \sqrt{\frac{1}{6}\sum\left(\text{EBIT} - \underset{7492}{\mu}\right)^2} = 12.367$$