



Stockholms  
universitet

**OBS! Läs noga igenom anvisningarna i tentamen, t.ex. hur du ska skriva svaren.  
Det är ditt ansvar som student att följa de anvisningar som ges.**

**NOTE! Read the examination instructions carefully, e.g. how to write the answers.  
It is your responsibility as a student to follow the given instructions.**

Skriv din anonymiseringskod och dagens datum på allt material du lämnar in.  
(Enter your anonymization code and today's date on all submitted materials)

Anonymiseringskod (Anonymization code)	3	1	1	-	0	0	0	8	-	D	H	W
Datum (Date YYYY-MM-DD)	2023-12-05							Plats nr. (Seat No.)	39			

Kurs/Kurskod (Course/Course code)	ST1701
Kursmoment (Course component)	

Fylls i av tentamensvärd (To be filled in by invigilator)

Direkt i skrivning: (kryss)		Svarsblankett: (kryss)		Lösa svarsblad: (antal)	2
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Lämnat in blankt: (kryss)		Dator: (kryss)	X
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Inlämningstid: 13 : 00

Signatur tentamensvärd: Jo

Fylls i av lärare/examinator (To be filled in by teacher/examinator)

Betyg:	A	Poäng:	
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Signatur rättande lärare/examinator: AA

Uppg.nr.:  
(Task no.)  
**1**

Lärarens kommentar:  
(Teacher's note)

**1)**

$$Y = \beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot X_2 + \beta_3 \cdot X_3$$

**a)**

$$H_0: X_3 = 0 \quad \text{vs.} \quad H_1: X_3 \neq 0$$

class 3 ( $X_3$ ) has a p-value = 0,000  
 $0,000 < 0,05 \rightarrow$  We can therefore reject the null hypothesis ( $H_0$ ) and conclude that class 3 is significantly different from 0. **OK**

**b)**

odds-ratio for the variable gender ( $X_2$ )

$$\frac{e^{\beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot (X+1) + \beta_3 \cdot X_3}}{e^{\beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot X_2 + \beta_3 \cdot X_3}} = e^{\beta_2} = e^{3,084} = 21,84561031$$

**interpretation!**  
 This means that the odds of surviving the sinking of titanic for a female in contrast to for a male is approximately 21,8 **OK**

**c)**

$$P(A | X_2=0, X_1=20, X_3=1)$$

$$\frac{e^{\beta_0 + \beta_1 \cdot 20 + \beta_2 \cdot 0 + \beta_3 \cdot 1}}{1 + e^{\beta_0 + \beta_1 \cdot 20 + \beta_2 \cdot 0 + \beta_3 \cdot 1}} = \frac{e^{\beta_1 \cdot 20 + \beta_3 \cdot 1}}{1 + e^{\beta_1 \cdot 20 + \beta_3 \cdot 1}} = \frac{e^{-0,5 + (-1,857)}}{1 + e^{-0,5 + (-1,857)}} = \frac{e^{-2,357}}{1 + e^{-2,357}} = \frac{0,0947039092}{1,0947039092} = 0,1894078184 \quad (18,94\%)$$

Answer: estimated probability is approximately 18,94%  
 Confidence interval? **OK**

**Sat -**

Poäng:  
(Points)

Sidnr.:  
(Page no.)

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(Task no.)

Lärarens  
kommentar:  
(Teacher's  
note)

Poäng:  
(Points)

The autocorrelation function for the MA(1) process!

$$\text{Corr}(Z_t, Z_{t-k}) = \begin{cases} -0,46 & \text{for } k=1 \\ 0 & \text{for } k>1 \end{cases}$$

(+)

b)

$$Z_t = \varepsilon_t - 1,5\varepsilon_{t-1} + 0,6\varepsilon_{t-2}$$

$$\begin{aligned} V(Z_t) &= V(\varepsilon_t - 1,5\varepsilon_{t-1} + 0,6\varepsilon_{t-2}) \\ &= (-1,5^2 + 1 + 0,6^2) V(\varepsilon_t) \\ &= 3,61 V(\varepsilon_t) \end{aligned}$$

$$\text{COV}(Z_t, Z_{t-1}) = \text{COV}(\varepsilon_t - 1,5\varepsilon_{t-1} + 0,6\varepsilon_{t-2}, \varepsilon_{t-1} - 1,5\varepsilon_{t-2} + 0,6\varepsilon_{t-3})$$

$$\begin{aligned} &= \text{COV}(\varepsilon_t, \varepsilon_{t-1}) + \text{COV}(\varepsilon_t, -1,5\varepsilon_{t-2}) \\ &\quad + \text{COV}(\varepsilon_t, 0,6\varepsilon_{t-3}) + \text{COV}(-1,5\varepsilon_{t-1}, \varepsilon_{t-1}) \\ &\quad + \text{COV}(-1,5\varepsilon_{t-1}, -1,5\varepsilon_{t-2}) + \text{COV}(-1,5\varepsilon_{t-1}, \end{aligned}$$

$$\text{Corr}(Z_t, Z_{t-k}) = \begin{cases} -0,66 & k=1 \\ 0,1662 & k=2 \\ 0 & \text{for } k>2 \end{cases}$$

$$= \text{COV}(-1,5\varepsilon_{t-1}, \varepsilon_{t-1}) + \text{COV}(0,6\varepsilon_{t-2}, -1,5\varepsilon_{t-2})$$

$$= ((-1,5 \cdot 0,6) + (-1,5)) V(\varepsilon_t)$$

$$= -2,4$$

$$\text{COV}(Z_t, Z_{t-2}) = \text{COV}(\varepsilon_t - 1,5\varepsilon_{t-1} + 0,6\varepsilon_{t-2}, \varepsilon_{t-2} - 1,5\varepsilon_{t-3} + 0,6\varepsilon_{t-4})$$

$$= \text{COV}(0,6\varepsilon_{t-2}, \varepsilon_{t-2}) \text{ The same as above!!}$$

$$= 0,6 V(\varepsilon_t)$$

$$\begin{aligned} \text{COV}(Z_t, Z_{t-3}) &= \text{COV}(\varepsilon_t - 1,5\varepsilon_{t-1} + 0,6\varepsilon_{t-2}, \varepsilon_{t-3} - 1,5\varepsilon_{t-4} + 0,6\varepsilon_{t-5}) \\ &= 0 \end{aligned}$$

$$\text{Corr}(Z_t, Z_{t-1}) = \frac{-2,4 V(\varepsilon_t)}{3,61 V(\varepsilon_t)} = -0,66$$

$$\text{Corr}(Z_t, Z_{t-2}) = \frac{0,6 V(\varepsilon_t)}{3,61 V(\varepsilon_t)} = 0,1662$$

$$\text{Corr}(Z_t, Z_{t-3}) = 0 / 3,61 = 0$$

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Uppg.nr.:  
(Task no.)

2

Lärarens kommentar:  
(Teacher's note)

2/ a/ MA(1) process  $Z_t = \epsilon_t - 1.5\epsilon_{t-1}$   
assume that  $Z_t$  is stationary

$$\begin{aligned} V(Z_t) &= V(\epsilon_t - 1.5\epsilon_{t-1}) \\ &= V\epsilon_t - 1.5^2 V(\epsilon_{t-1}) \\ &= (1 - 1.5^2) V(\epsilon_t) \\ &= \underline{3.25 V(\epsilon_t)} \end{aligned}$$

$$\begin{aligned} \text{COV}(Z_t, Z_{t-1}) &= \text{COV}(\epsilon_t - 1.5\epsilon_{t-1}, \epsilon_{t-1} - 1.5\epsilon_{t-2}) \\ &= \text{COV}(\epsilon_t, \epsilon_{t-1}) + \text{COV}(\epsilon_t, -1.5\epsilon_{t-2}) \\ &\quad + \text{COV}(-1.5\epsilon_{t-1}, \epsilon_{t-1}) + \text{COV}(-1.5\epsilon_{t-1}, -1.5\epsilon_{t-2}) \\ &= \text{COV}(-1.5\epsilon_{t-1}, \epsilon_{t-1}) \\ &= -1.5 V(\epsilon_t) \end{aligned}$$

$$\begin{aligned} \text{COV}(Z_t, Z_{t-2}) &= \text{COV}(\epsilon_t - 1.5\epsilon_{t-1}, \epsilon_{t-2} - 1.5\epsilon_{t-3}) \\ &= \text{COV}(\epsilon_t, \epsilon_{t-2}) + \text{COV}(\epsilon_t, -1.5\epsilon_{t-3}) \\ &\quad + \text{COV}(-1.5\epsilon_{t-1}, \epsilon_{t-2}) + \text{COV}(-1.5\epsilon_{t-1}, -1.5\epsilon_{t-3}) \\ &= 0 \end{aligned}$$

$$\text{Corr}(Z_t, Z_{t-1}) = \frac{-1.5 \cdot V(\epsilon_t)}{3.25 \cdot V(\epsilon_t)} = -0.4615384615 \quad (-0.46) \quad \text{OK}$$

$$\text{Corr}(Z_t, Z_{t-2}) = \frac{0}{3.25 \cdot V(\epsilon_t)} = 0$$

Continue on next page!

Poäng:  
(Points)

## Regler i skrivsalen

- Följ tentamensvärds anvisningar.
- Väskor och ytterkläder ska placeras på anvisad plats.
- Placera ID-handling väl synlig på bordet framför dig.
- Ingen student får lämna skrivsalen under de första 30 minuterna.
- Endast en student i taget får besöka toaletten. Vid toalettbesök skriv ditt namn och klockslag på avsedd lista. Efter toalettbesöket ska du åter ange klockslag på listan.
- Elektronisk utrustning som mobiltelefon eller Smartwatch ska vara avstängd och placerad på anvisad plats.
- Under tentamen gäller tystnad – det är förbjudet att prata, eller på annat sätt kommunicera, med andra studenter under pågående tentamen.
- Innan tentamenshandlingarna lämnas in; skriv sidnummer, anonymiseringskod och datum på alla inlämnade papper.

Om något är oklart – fråga gärna tentamensvärden. Lycka till!

## Rules in the examination hall

- Follow the invigilator's instructions.
- Bags and outerwear must be placed at the designated place.
- Place your ID document clearly visible on the table in front of you.
- No student may leave the examination hall for the first 30 minutes.
- Only one student at a time may visit the toilet. Before visiting the toilet, write your name and time on the intended list. After the toilet visit, enter the time on the list again.
- Electronic equipment such as a mobile phone or Smartwatch must be switched off and placed at the designated place.
- During the exam, silence applies – you are not allowed to talk, or otherwise communicate, with other students during the exam.
- Before submitting the examination documents; remember to write the page number, anonymization code, and date on all papers.

Please do not hesitate to ask the invigilator if anything is unclear. Good luck!