Excercise exam: Finansiell Risk, MVE 220/MSA400

Allowed material: List of Formulas, BETA, Chalmers allowed calculator.

Scoring: Multiple choice questions, only one correct answer. Correct answer gives 2 points, no answer ("don't know") gives 0 points and wrong answer gives -0.5 points (more than one answer automatically gives -0.5 points).

Fill out the first page, and turn in the entire exam. Only what you have written on the first page counts for the grade.

Uppgift	a	b	c	d	e	f (Don't know)	Points
1	☐	☐	☐	☐	☐	☐	
2	☐	☐	☐	☐	☐	☐	
3	☐	☐	☐	☐	☐	☐	
4	☐	☐	☐	☐	☐	☐	
5	☐	☐	☐	☐	☐	☐	
6	☐	☐	☐	☐	☐	☐	
7	☐	☐	☐	☐	☐	☐	
8	☐	☐	☐	☐	☐	☐	
9	☐	☐	☐	☐	☐	☐	
10	☐	☐	☐	☐	☐	☐	
11	☐	☐	☐	☐	☐	☐	
12	☐	☐	☐	☐	☐	☐	
13	☐	☐	☐	☐	☐	☐	
14	☐	☐	☐	☐	☐	☐	

Signature:

Name (print):

1 Consider the following statements:

1 Everyone who buys into a Ponzi Scheme will loose money.

2 Some big banks, like Banco Santander and the Central Bank of Ireland invested in Bernard Madoff Investment Securities

3 Price-Waterhouse-Cooper were accountants for Bernard Madoff Investment Securities

4 The SEC discovered that Bernard Madoff Investment Securities was a fraud and reported him to the police

5 Nobody discovered that Bernard Madoff Investment Securities was a fraud, until his sons reported him to the police

6 In the yearly statments Madoff reported investments which never were made, but which one at the time of reporting were known to have made much money.

Which of the following is true?

(a) ☐1, 3, 5 are correct; 2, 4, 6 are wrong

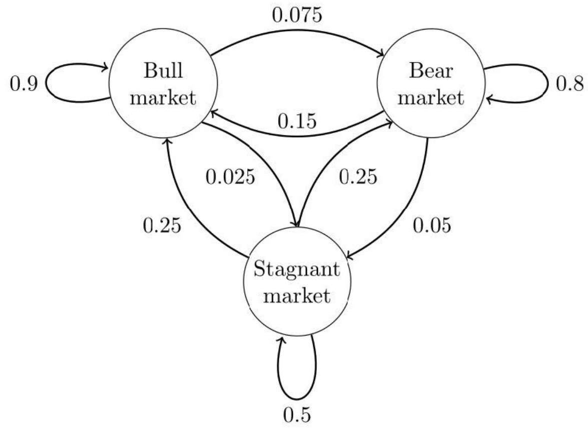
(b) ☐ 2, 6, are correct; 1, 3, 4, 5 are wrong

(c) ☐ 4, 5, 6 are correct; 1, 2, 3 are wrong

(d) ☐ 3, 6 are correct; 1, 2, 4, 5 are wrong

(e) ☐ None of the above

(f) ☐ Don't know.



2 Consider the following statements:

1 Markov chains can be used to study credit ratings

2 A stochastic process is a Markov chain if the past and the future are conditionally independent if one knows the state today

3 Marov chains are not suitable for modelling business cycles

4 In the figure above is a graphical representation of a Markov chain

5 In the figure above, 0.15 is the probability that a Bull Market week is followed by a Bear Market week

6 In a Markov chains the probabilities to be in the different states often converges as one goes further and further out into the future

Which of the following is true?

(a) ☐ All the statements are correct

(b) ☐ 2, 6, are correct; 1, 3, 4, 5 are wrong

(c) ☐ 4, 5, 6 are correct; 1, 2, 3 are wrong

(d) ☐1, 3, 5, 6 are correct; 2, 4 are wrong

(e) ☐ None of the above

(f) ☐ Don't know.

3 Consider the following statements:

1 Bitcoin is owned by the bitcoin foundation

2 In a bitcoin transaction the identities of seller and buyer are secret

3 In bitcoin "mining" is to solve a mathematical puzzle

4 Mining becomes easier as time goes on

5 The blockchain in Bitcoin can described as a secure decentralized database that contains all the Bitcoin transactions ever made

6 There is an special procedure to get your bitcoin back if it is lost or stolen

Which of the following is true?

(a) ☐1, 3, 5 are correct; 2, 4, 6 are wrong

(b) ☐ 1, 6, are correct; 2, 3, 4, 5 are wrong

(c) ☐ 2, 3, 5 are correct; 1, 4, 6 are wrong

(d) ☐ 3, 5 are correct; 1, 2, 4, 6 are wrong

(e) ☐ None of the above

(f) ☐ Don't know

4 In the Peaks over Thresholds method one often makes a plot of *estimated scale parameter* $-$ *estimated shape parameter* $\times$ *level* as a function of the level u used to define the excesses. This plot is used to

(a) ☐ Check if the observations are stationary

(b) ☐ Decluster the excesses

(c) ☐ Select the level used in the PoT analysis

(d) ☐ Compare the Bock Maxima VaR and the PoT VaR

(e) ☐ None of the above

(f) ☐ Don't know

5 Suppose $X_1, X_2, \ldots$ are independent and uniformly distributed random variables (so that their cumulative distribution function $F(x) = x$ for $x \in [0,1]$), and define $M_n = \max\{X_1, \ldots X_n\}$. Then

$$P(\frac{M_n - a_n}{b_n}) \to e^{-e^{-x}}, \quad \text{as } n \to \infty$$

if

(a) ☐ $a_n = 1/n, b_n = n$
(b) ☐ $a_n = n, b_n = 1/n$
(c) ☐ $a_n = 1/n, b_n = 1 - 1/n$
(d) ☐ $a_n = 1 - 1/n, b_n = n$
(e) ☐ None of the above
(f) ☐ Don't know

6 Likelihood ratio tests can be used to

(a) ☐ Check if there is a trend in the cost of windstorm claims

(b) ☐ Derive the limiting distribution of threshold excesses

(c) ☐ Estimate the scale parameter in a stationary GEV model for monthly maxima of Dow Jones returns

(d) ☐ Choose the level in PoT analysis

(e) ☐ None of the above

(f) ☐ Don't know

7 Let X_1 and X_2 be independent random variables which both have a GEV distribution function with shape parameter $\gamma = 0$, scale parameter $\sigma = 1.3$ and location parameter $\mu = 2.1$, so that they both have cumulative distribution function

$$G(x) = e^{-e^{\frac{x-2.1}{1.3}}}.$$

Then also $M = \max X_1, X_2$, the maximum of X_1 and X_2, has a GEV distribution function.

The shape, scale, and location parameters of this GEV distribution function of M are

(a) ☐ $\gamma = 0, \sigma = 1.3, \mu = 2.1 - 1.3\log(2)$

(b) ☐ $\gamma = \log 2, \sigma = 1.3, \mu = 2.1 - 1.3\log(2)$

(c) ☐ $\gamma = 0, \sigma = 1.3\log 2, \mu = 2.1 - 1.3\log(2)$

(d) ☐ $\gamma = 0, \sigma = 1.3, \mu = 2.1 + 1.3\log(2)$

(e) ☐ None of the above

(f) ☐ Don't know

data. This leads to the maximum likelihood estimate

$$(\hat{\mu}, \hat{\sigma}, \hat{\xi}) = (-1.64, 0.27, -0.084),$$

with a maximized value of the log-likelihood equal to -14.3. The corresponding estimated variance-covariance matrix is

$$V = \begin{bmatrix} 0.00141 & 0.000214 & -0.000795 \\ 0.000214 & 0.000652 & -0.000441 \\ -0.000795 & -0.0000441 & 0.00489 \end{bmatrix}.$$

8 Above are shown the maximum likelihood estimates and the estimates of the covariance matrix from the block maxima method applied to a data set on glass fibre strengths.

A 95% confidence interval for the scale parameter σ is given by

(a) ☐ $(1.64 - 1.64 \times 0.00141, 1.64 + 1.64 \times 0.00141)$

(b) ☐ $(1.64 - 1.96 \times \sqrt{0.000652}, 1.64 + 1.96 \times \sqrt{0.000652}$

(c) ☐ $(0.27 - 1.64 \times \sqrt{0.000652}, 0.27 + 1.64 \times \sqrt{0.000652}$

(d) ☐ $(0.84 - 1.96 \times \sqrt{0.000489}, 0.84 + 1.96 \times \sqrt{0.000489})$

(e) ☐ None of the above

(f) ☐ Don't know

9 Consider a static credit portfolio with 1000 obligors which we model as mixed binomial model inspired by the Merton framework. The individual one-year default probability is $\bar{p} = 5\%$, the individual loss is $\ell = 60\%$, the default correlation is $\rho = 25\%$ and each loan have notional 1 million SEK. Use the large portfolio approximation (LPA) formula to compute the probability that within one year, the total portfolio credit loss will be more than 50 million SEK but less than 100 million SEK.

(a) ☐ 9.5%

(b) ☐ 10.2%

(c) ☐ 13.2%

(d) ☐ 14.6%

(e) ☐ None of the above

(f) ☐ Don't know

10 Consider a static credit portfolio with $m = 1000$ obligors which we model as mixed binomial model inspired by the Merton framework. The individual one-year default probability is $\bar{p}$, the individual loss is $\ell = 60\%$ and the default correlation is $\rho = 12\%$. Each loan have notional 1 million SEK. We also know that the probability that within one year, the total portfolio credit loss will be less than 20 million SEK is 53.5%. Use the LPA-approximation formula to compute the probability that within one year, the total portfolio credit loss will be more than 50 million SEK but less than 100 million SEK.

(a) ☐ 6.7%
(b) ☐ 8.8%
(c) ☐ 9.4%
(d) ☐ 11.3%
(e) ☐ None of the above
(f) ☐ Don't know

11 Consider a static credit portfolio with $m = 1000$ obligors which we model as mixed binomial model with a logit-normal mixing distribution (for one year, say) and where each loan have notional 1 million SEK and the individual loss is $\ell = 60\%$. We know that the one-year LPA-VaR formula produces the values $\mathrm{VaR}_{95\%}(L) = 116.9$ million SEK and $\mathrm{VaR}_{99\%}(L) = 254.2$ million SEK. Given this, compute the one-year $\mathrm{VaR}_{\alpha}(L)$ for $\alpha = 99.9\%$ with the LPA-VaR formula.

(a) ☐ 431 million SEK

(b) ☐ 484 million SEK

(c) ☐ 508 million SEK

(d) ☐ 534 million SEK

(e) ☐ None of the above

(f) ☐ Don't know

12 Consider a static credit portfolio with m obligors. We model this portfolio as a mixed binomial model with a one-year default mixing distribution $p(Z) = \frac{Z}{K}$ where Z is a binomially distributed random variable, $Z \sim \mathrm{Bin}(K, q)$ for $0 < q < 1$ and K is an integer such that $K \geq 2$. If $m = 10$, $K = 3$ and $q = 0.05$ compute the probability of having no defaults in this portfolio within one year.

(a) ☐ 25.0%

(b) ☐ 73.4%

(c) ☐ 86.0%

(d) ☐ 93.1%

(e) ☐ None of the above

(f) ☐ Don't know

13 Consider a static credit portfolio with m obligors. We model this portfolio as a mixed binomial model with a one-year default mixing distribution $p(Z) = \frac{Z}{K}$ where Z is a binomially distributed random variable, $Z \sim \mathrm{Bin}(K, q)$ for $0 < q < 1$ and K is an integer such that $K \geq 2$. If $m = 100$, $K = 5$ and $q = 0.05$ compute the pairwise default correlation $\rho_X = \mathrm{Corr}(X_i, X_j)$ for $i \neq j$.

(a) ☐ 0.025

(b) ☐ 0.1

(c) ☐ 0.2

(d) ☐ 0.25

(e) ☐ None of the above

(f) ☐ Don't know

14 Consider a static credit portfolio with m obligors which we model as mixed beta binomial model with parameter a and b for one year, that is the one-year conditional default probability $p(Z)$ is given by $p(Z) = \mathbb{P}[X_i = 1 \mid Z] = Z$ where $Z \sim \mathrm{Beta}(a, b)$. Let $a = 2$ and $\mathbb{E}[p(Z)] = 0.1$. Compute the pairwise default correlation $\rho_X = \mathrm{Corr}(X_i, X_j)$ for $i \neq j$.

(a) ☐ 0.0476

(b) ☐ 0.0531

(c) ☐ 0.142

(d) ☐ 0.193

(e) ☐ None of the above

(f) ☐ Don't know