Examples of true-false questions

1. An investor holds a portfolio consisting of a \$2 mio investment in asset A and a \$4 mio investment in asset B. The return of both asset A and B is normally distributed, with a correlation of 0.78. The expected return on asset A is 24% p.a. with a volatility of 25%, while the expected return on asset B is 15% with a volatility of 13%. The probability to incur a loss over one year is 10.23%.

2. The Cornish-Fisher expansion to quantile estimation is highly relevant in the context of options.

3. Assuming a market model with a single risk factor X delta-normal VaR of the losses ΔP reduces to $\beta \times \sigma_{\frac{\Delta X}{X}} \times N_{1-c}^{-1} \times \sqrt{\tau}$.
4. VaR is a not subadditive.

5. Assume you are short a forward contract on Unilever stocks. If the counterparty defaults before maturity you incur a credit loss.

6. The correlation metric is only accurate as a measure of co-movement for elliptical distributions.

Market risk of a foreign-currency denominated bond

You are short a GBP denominated zero-coupon bond, with a face value of £1 million, and a remaining maturity of 6 months. The daily return of a 6-month zero GBP bond has a volatility of 0.06% (when its price is converted into Euro). The current exchange rate is 0.88 Pound Sterling per Euro. Assume that the 6-month interest rate in GBP is 5% per annum with continuous compounding.

1. Compute the 10-day 99% relative normal VaR (hint: start by defining the volatility of the P&L of your investment)
2. Assume that information about the bond return volatility of this specific bond is not readily available, what would be (an) alternative(s) to the above VaR approach?

Market risk of a portfolio of instruments

You have written 500 call options on the stock of AB Inbev stock. Currently AB Inbev's stock is trading at €73.35, with a return's volatility of 17.20% per annum. The call options have a delta of 0.6. In addition, you have bought 260 AB Inbev stocks.

1. What is the 95% 10-day normal VaR for this portfolio
2. Based on 250 data records, the VaR limit is breached 11 times. What are the implications, and why is this important?

Credit risk of a portfolio of 3 independent bonds

Consider a portfolio consisting of three bonds: an Aa-rated bond, a Ba-rated bond and a Caa-rated bond. One-year probabilities of rating transition and fixed credit exposures are summarized here below.

Initial rating	Rating at year end								
	Aaa	**Aa**	**A**	**Baa**	**Ba**	**B**	**Caa**	**Ca-C**	**Default**
Aaa	90.42	8.92	0.62	0.01	0.03	0.00	0.00	0.00	0.00
Aa	1.02	90.12	8.38	0.38	0.05	0.02	0.01	0.00	0.02
A	0.06	2.82	90.88	5.52	0.51	0.11	0.03	0.01	0.06
Baa	0.05	0.19	4.79	89.41	4.35	0.82	0.18	0.02	0.19
Ba	0.01	0.06	0.41	6.22	83.43	7.97	0.59	0.09	1.22
B	0.01	0.04	0.14	0.38	5.32	82.19	6.45	0.74	4.73
Caa	0.00	0.02	0.02	0.16	0.53	9.41	68.43	4.67	16.76
Ca-C	0.00	0.00	0.00	0.00	0.39	2.85	10.66	43.54	42.56

Rating	Exposure
Aa	20
Ba	10
Caa	5

Assume further that the loss given default is non-random, that recovery is equal to zero, and that the default probabilities of the different bonds are independent.

1. What is the 1-year volatility of the credit losses from default?
2. What is the corresponding 1-year 99% credit VaR?
3. Which of the above 2 measures is more appropriate, and why?

Credit risk of a portfolio of 2 dependent bonds

Consider a portfolio of 2 bonds. The first bond is a 3-year B subordinated bond with annual coupons of 6% and face value €10,000. The bond is currently selling at 98.40% of its face value. The second bond is a 2-year A senior secured bond with annual coupons of 4% and a face value of €20,000. The bond is currently selling at 100.38% of its face value. The bonds have a default correlation of 5%.

Assume the following simplified 1-year transition rates:

	No default	Default
AAA	100%	0%
AA	100%	0%
A	99.94%	0.06%
BBB	99.82%	0.18%
BB	98.94%	1.06%
B	94.8%	5.20%
CCC/C	80.21%	19.79%

To compute the 1-year forward value of the bond, the following 1- year forward pricing functions can be used:

Rating specific forward discount rates (in % per annum)

year end rating	year 1	year 2	year 3	year 4	year 5
AAA	3.60	4.17	4.73	5.12	5.35
AA	3.65	4.22	4.78	5.17	5.65
A	3.72	4.32	4.93	5.32	5.99
BBB	4.10	4.67	5.25	5.63	6.11
BB	5.55	6.02	6.78	7.27	7.85
B	6.05	7.02	8.03	8.52	9.31
CCC/C	15.05	15.02	14.03	13.52	13.51

Seniority-specific recovery rates (as % of par value)

seniority class	mean (%)	standard deviation (%)
senior secured	50.21	27.86
senior unsecured	48.22	26.85
senior subordinated	35.68	27.80
subordinated	30.53	20.25
junior subordinated	14.12	18.50

Assuming that the bonds can either default, or not default, what is the 1-year 99.9% credit VaR of this portfolio? Assume that the bonds keep their original rating in the no default state, and that the credit VaR needs to be computed, just before the first coupons are received.

Please note that the probability that both bonds default, in case of dependence, is computed as:

$$PD_1 \times PD_2 + \rho_{12}\sqrt{PD_1(1-PD_1)}\sqrt{PD_2(1-PD_2)}$$