20. (3.75 points)

A monoline property and casualty insurance company is testing scenarios for its Dynamic Capital Adequacy Testing (DCAT) report. One of the scenarios modelled is a catastrophe occurring on January 1, 2019. The amount of loss at different percentiles of the modelled cumulative distribution are listed below. All amounts are in thousands of dollars ($000s).

Percentile	Gross Catastrophe Loss
90th	100,000
93th	350,000
96th	605,000

The company purchases catastrophe excess-of-loss reinsurance coverage with the following two registered reinsurance companies:

- Reinsurer A: 150,000 xs 50,000
- Reinsurer B: 400,000 xs 200,000

There is no reinstatement premium.

Cumulative payment pattern for catastrophe claims:

Age (Months)	% Cumulative Paid
12	60%
24	100%

Payments are made in the middle of the year. The payment pattern is the same for the insurer and the reinsurers.

<< QUESTION 20 CONTINUED ON NEXT PAGE >>

Projected MCT results for the first year:

	Base Scenario at 2019/12/31	Adverse Scenario at 2019/12/31
Capital available	37,750	27,000
Capital required for premium liabilities	1,500	1,800
Capital required for unpaid claims	12,750	?
Capital required for catastrophes	300	300
Capital required for reinsurance ceded to unregistered insurers	0	0
Capital required for interest rate risk	2,000	1,750
Capital required for foreign exchange risk	0	0
Capital required for equity risk	1,600	1,600
Capital required for real estate risk	0	0
Capital required for other market risk exposures	450	450
Capital required for counterparty default risk for balance sheet assets	700	700
Capital required for counterparty default risk for off balance sheet exposures	100	100
Capital required for counterparty default risk for unregistered reinsurance collateral and SIRs	0	0
Capital required for operational risk	2,900	4,300
Diversification credit	1,900	?
MCT ratio	278%	?

Other information:

Risk factor for unpaid claims	15%
Discount rate	3%
Claim liabilities margin for adverse deviation (MfAD)	10%
Correlation factor between asset risk margin and insurance risk margin	50%

<< QUESTION 20 CONTINUED ON NEXT PAGE >>

a. (0.5 point)

Briefly describe two purposes of stress testing.

b. (0.5 point)

Define reverse stress testing and briefly describe how it can help the insurer with its DCAT analysis.

c. (2.25 points)

Calculate the MCT ratio for the plausible adverse catastrophe scenario as at December 31, 2018.

d. (0.5 point)

The company decides to model an additional scenario that includes both the catastrophe and the bankruptcy of a reinsurer. Describe how this would impact the MCT ratio calculated in part c. above.

CONTINUED ON NEXT PAGE

QUESTION 20	
TOTAL POINT VALUE: 3.75	**LEARNING OBJECTIVE(S): C2**

SAMPLE ANSWERS

Part a: 0.5 point

Sample answers (two of the following)

- Risk identification and control
- To complement other risk management tools
- Support capital management
- Improve liquidity management
- To evaluate the financial condition of the company
- Aid in setting internal capital targets

Part b: 0.5 point

Sample 1

Determine how far risk factors need to change to result in negative surplus, then determine if the change is plausible. Can help select the plausible adverse scenarios for DCAT.

Sample 2

Reverse stress testing is done by identifying scenarios that would adversely affect the company, such as causing surplus to be negative. Done by changing risk factors and then assessing whether or not such scenarios are plausible.

Part c: 2.25 points

Sample 1

Plausible adverse scenario: use 96^{th} percentile => Gross Cat Loss = 605,000
With excess of loss reinsurance: Net Cat Loss = 605,000 – 400,000 – 150,000 = 55,000

PV(Unpaid Cat Loss) = 55,000 x 0.4 x $1.03^{-0.5}$ = 21,677
CapReq(Unpaid Cat Claims) = (net APV(Unpaid Claims) – pfads) x risk factor
= 21,677 x 15% = 3,252
CapReq(Unpaid Claims, adverse) = 12,750 + 3,252 = 16,002
CapReq(Insurance Risk) = 1,800 + 16,002 + 300 = 18,102
CapReq(Market Risk) = 1,700 + 1,600 + 450 = 3,800
CapReq(Credit Risk) = 700 + 100 = 800
A = 3,800 + 800 = 4,600
Diversification Credit = 4,600 + 18,102 – sqrt(4600^2 + 18102^2 + 2(0.5)(18,102)(600))
= 1,915
Target Capital Required = 4,600 + 18,102 + 4,300 – 1,915 = 25,087
MCT Ratio = 27,000 / (25,087/1.5) = 161%

Sample 2

Plausible scenario => between 95^{th} and 99^{th} => 96^{th} percentile
Cat Loss = 605,000
150,00 ceded to reins A
400,000 ceded to reins B

55,000 retained by insurer

60% pay in 2019, 40% pay in 2020

PV(@3%) = $0.6(1.03)^{-0.5} + 0.4(1.03)^{-1.5} = 0.97385$
PV(Cat) = 53,562
Additional cap for unpaid = 53,562 x 0.15 = 8,034
Cap required for unpaid for adverse scenario = 12,750 + 8,034 = 20,784

Insurance Risk = 1,800 + 20,784 + 300 = 22,884
Asset Risk = 1,750 + 1,600 + 450 + 700 + 100 = 4,600
Target Capital = $4,300 + \text{sqrt}(22884^2 + 4{,}600^2 + 22{,}884 \times 4{,}600) = 29{,}797$

MCT = 27,000 / (29,797/1.5) = 135.9%

Part d: 0.5 point

Sample 1
It will increase the insurance risk as unpaid claim risk increases. Thus, MCT will decrease.

Sample 2
Capital available would go down. Credit risk would increase, which would increase the capital required. MCT ratio would go down.

EXAMINER'S REPORT

Candidates were expected to understand aspects of the DCAT process including stress testing, reverse stress testing, and the impact of scenario testing to the capital ratio.

Part a

Candidates were expected to be able to describe the purposes of stress testing.

There were no common errors identified.

Part b

Candidates were expected to define reverse stress testing and relate this testing to the DCAT analysis.

A common error included:

- Failing to mention how reverse stress testing can help the insurer with its DCAT analysis.

Part c

Candidates were expected to calculate the MCT ratio under the conditions of the plausible adverse scenario.

Regrettably, there was a typographical error in this part of the question; the calculation year was misstated as 2018 when it was intended to be 2019. Given this error, multiple interpretations of discounting and payment patterns were accepted.

Common errors included:

- Including MfADs in the calculation
- Failing to account for the capital required under the base scenario
- Failing to calculate the net cat losses under the adverse scenario correctly
- Failing to incorporate the payment pattern to obtain the correct discounted unpaid claims liability
- Failing to include all components in calculating Insurance, Market, Credit risk, or errors while calculating the Diversification Credit

Part d

Candidates were expected to interpret how the MCT ratio would change under an additional adverse scenario.

A common error included:

- Concluding the MCT ratio would increase