Lesson 4.3 Exercises: Institutional Risk Management

Module 4: The Risk Problem

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Digital Finance — BSc Course

Exercise 1: Risk-Weighted Assets Calculation

Scenario: A regional bank has the following asset portfolio (synthetic data):

Asset Class	Exposure ($M)	Risk Weight
Cash and central bank reserves	50	0%
OECD sovereign bonds (AA-rated)	120	0%
Claims on other OECD banks	80	20%
Residential mortgages	300	35%
Investment-grade corporate loans	200	50%
Unsecured consumer loans	150	75%
Sub-investment-grade corporate loans	100	100%

Tasks:

a. Calculate the **RWA for each asset class** and the **total RWA**.

b. The bank has CET1 capital of $28M, AT1 of $5M, and Tier 2 of $7M. Calculate the **CAR** and the **CET1 ratio**.

c. Does the bank meet the Basel III minimum requirements (CET1 $\geq$ 4.5%, CAR $\geq$ 8%)? Does it meet the conservation buffer (CET1 $\geq$ 7%)?

d. If the bank wants a CET1 ratio of 10%, how much **additional CET1 capital** does it need?

Difficulty: Intermediate — requires multi-step arithmetic.

Exercise 2: Liquidity Coverage Ratio

Scenario: A bank holds the following liquid assets and faces these 30-day outflows (synthetic data):

HQLA Portfolio:

Asset	Value ($M)
Gov. bonds (Level 1)	100
Corp. bonds AA (L2A)	40
Equities (L2B)	20

Haircuts: L1 = 0%, L2A = 15%, L2B = 50%.

30-Day Outflows:

Source	Outflow ($M)
Retail deposits (5%)	30
Wholesale unsecured (40%)	50
Committed lines (10%)	20
Total	**100**

Tasks:

a) Calculate the **adjusted HQLA** after applying haircuts.

b) Calculate the **LCR**. Does the bank meet the 100% minimum?

c) The bank loses a major corporate depositor, adding $25M to wholesale outflows. Recalculate the LCR. Does the bank still comply?

d) Propose two actions the bank could take to restore the LCR above 100% if it falls below.

Difficulty: Intermediate — requires arithmetic and reasoning.

Exercise 3: Stress Test Impact on Capital

Scenario: A bank enters a stress test with the following starting position (synthetic data):

- Total RWA: \$800M
- CET1 capital: \$96M (CET1 ratio: 12.0%)
- Credit portfolio: \$600M in corporate loans (100% RW), \$200M in mortgages (35% RW)

Adverse scenario assumptions (over 2 years):

- Corporate loan default rate increases from 2% to 8%; LGD = 45%
- Mortgage default rate increases from 0.5% to 3%; LGD = 25%
- RWA increases by 10% due to rating downgrades
- Pre-provision operating income: \$20M per year (partially offsets losses)

Tasks:

a. Calculate total **credit losses** under the adverse scenario (2-year cumulative).
b. Calculate **CET1 capital at the trough** (starting CET1 − losses + operating income).
c. Calculate the **stressed CET1 ratio** (using the 10%-higher RWA).
d. Does the bank breach the 7.0% combined requirement? What actions should it take?

Difficulty: Advanced — requires multi-step scenario modeling.

Exercise 4: Credit Portfolio Expected Loss

Scenario: A bank's loan book consists of three segments (synthetic data):

Segment	EAD ($M)	PD	LGD
Investment-grade corporates	500	0.5%	40%
SME loans	200	3.0%	55%
Unsecured consumer credit	100	5.0%	70%

Tasks:

a. Calculate the **Expected Loss (EL)** for each segment and the **total portfolio EL**.

b. The bank charges an average spread of 2.5% on its $800M portfolio. Is the total interest income sufficient to cover expected losses? What is the excess?

c. If default correlations between segments increase during a recession, explain qualitatively how this affects **unexpected losses** even if PDs remain the same.

d. Why can the bank *not* simply set provisions equal to the expected loss and consider itself "safe"?

Difficulty: Intermediate — requires computation and interpretation.

Exercise 5: Capital Stack and Buffer Requirements

Scenario: A globally systemically important bank (G-SIB) has:

- Total RWA: \$2,000M
- CET1: \$220M; AT1: \$40M; Tier 2: \$60M
- G-SIB surcharge: 2.0%
- Countercyclical buffer (currently): 1.0%

Basel III combined requirements:

Requirement	CET1 (% of RWA)
Pillar 1 minimum	4.5%
Capital conservation buffer	2.5%
Countercyclical buffer	1.0%
G-SIB surcharge	2.0%
Total combined CET1 requirement	**10.0%**

Tasks:

a) Calculate the bank's CET1 ratio and CAR.

b) Does the bank meet all combined CET1 requirements?

c) The countercyclical buffer is raised to 2.5%. How much additional CET1 must the bank raise?

d) Explain why regulators impose **higher** capital requirements on G-SIBs compared to smaller banks.

Difficulty: Intermediate–Advanced — requires buffer stacking and reasoning.

Exercise 6: Operational Risk and Key Risk Indicators

Scenario: A bank's operational risk dashboard shows the following KRI trends over the last four quarters:

KRI	Q1	Q2	Q3	Q4
IT system outages (hours)	2	5	12	18
Failed trades (#)	15	22	35	48
Compliance breaches (#)	1	2	3	5
Staff turnover in risk (%)	8%	12%	18%	25%
Cyber incidents (#)	3	5	8	14

Tasks:

a) Identify the **three most concerning trends** and explain why each is worrying.

b) For each concerning KRI, propose a **concrete remediation action**.

c) The risk committee asks: "Is this just noise, or should we escalate to the board?" Write a brief (3–4 sentence) recommendation.

d) Explain how rising staff turnover in the risk function could **amplify** the other KRI trends.

Difficulty: Advanced — requires interpretation and recommendation.

Exercise 7: Reverse Stress Test Design

Scenario: You are the CRO of a mid-size bank with the following characteristics:

- 60% of the loan book is concentrated in commercial real estate (CRE)
- CET1 ratio: 10.5%
- LCR: 115%
- Heavy reliance on wholesale funding (NSFR: 95%)

Tasks:

a. Design a **reverse stress test scenario** that would cause the bank's CET1 ratio to fall below 4.5%. Specify at least 3 simultaneous shocks with quantitative magnitudes.

b. Explain why your scenario is **plausible** (not purely hypothetical). Reference a historical precedent for at least one of the shocks.

c. Identify **two mitigating actions** the bank should take *now* (before any crisis) to reduce the probability or impact of your scenario.

d. How does the bank's low NSFR (95%) interact with a CRE downturn to create a **combined solvency–liquidity crisis**?

Difficulty: Advanced–Integrative — requires synthesis and evaluation.

Exercise 8: Comprehensive Case – Comparing Two Banks

Scenario: An analyst compares two banks (all data synthetic):

Metric	Bank Alpha	Bank Beta
Total assets	$50B	$50B
RWA	$25B	$35B
CET1 capital	$3.0B	$3.5B
CET1 ratio	12.0%	10.0%
LCR	145%	105%
NSFR	112%	92%
NPL ratio	1.2%	3.8%
Stressed CET1 (trough)	8.5%	5.2%
IT outage hours (last year)	4	52
Revenue concentration: top 3 sectors	30%	65%

Tasks:

a. Which bank has a **riskier asset mix**? Justify using the RWA-to-assets ratio.

b. Which bank is **more resilient under stress**? Cite at least 3 metrics.

c. Bank Beta argues: "Our CET1 ratio is 10% — well above minimums." Write a 4–5 sentence rebuttal identifying the bank's vulnerabilities.

d. As an investor, which bank would you prefer, and what **risk premium** (in basis points of credit spread) would you demand for lending to the weaker bank? Justify your reasoning.

Difficulty: Advanced–Integrative — combines all lesson concepts into a holistic assessment.

Answer Key

Exercise 1:

(a) Cash: 0. Sovereigns: 0. Banks: \$80M $\times$ 20% = \$16M. Mortgages: \$300M $\times$ 35% = \$105M. IG corp: \$200M $\times$ 50% = \$100M. Consumer: \$150M $\times$ 75% = \$112.5M. Sub-IG: \$100M $\times$ 100% = \$100M. **Total RWA = \$433.5M.**

(b) CAR = (28+5+7)/433.5 = 40/433.5 = **9.22%**. CET1 ratio = 28/433.5 = **6.46%**.

(c) CET1 $\geq$ 4.5%: Yes (6.46%). CAR $\geq$ 8%: Yes (9.22%). Conservation buffer (CET1 $\geq$ 7%): **No** (6.46% $<$ 7%).

(d) Target CET1 = 10% $\times$ 433.5 = \$43.35M. Additional = \$43.35 $-$ \$28 = **\$15.35M**.

Exercise 2:

(a) HQLA = \$100 + (\$40 $\times$ 0.85) + (\$20 $\times$ 0.50) = \$100 + \$34 + \$10 = **\$144M**.

(b) LCR = 144/100 = **144%**. Yes, well above 100%.

(c) New outflows = 100 + 25 = \$125M. LCR = 144/125 = **115.2%**. Still compliant.

(d) (i) Purchase more Level 1 HQLA (government bonds). (ii) Extend deposit terms to reduce run-off assumptions.

Answer Key (continued)

Exercise 3:

(a) Corporate losses: $600M × 8% × 45% = $21.6M. Mortgage losses: $200M × 3% × 25% = $1.5M. **Total credit losses = $23.1M** (2-year cumulative).

(b) Trough CET1 = $96M − $23.1M + ($20M × 2) = $96 − $23.1 + $40 = **$112.9M**.

(c) Stressed RWA = $800M × 1.10 = $880M. Stressed CET1 ratio = 112.9/880 = **12.83%**. This bank actually survives well due to strong pre-provision income.

(d) The bank passes at 12.83% — well above 7.0%. No immediate action required, but continued monitoring is prudent.

Exercise 4:

(a) IG: $500M × 0.5% × 40% = $1.0M. SME: $200M × 3% × 55% = $3.3M. Consumer: $100M × 5% × 70% = $3.5M. **Total EL = $7.8M.**

(b) Interest income = $800M × 2.5% = $20M. Excess = $20M − $7.8M = **$12.2M**. Yes, sufficient with a comfortable margin.

(c) Higher correlation increases the probability that *many* borrowers default simultaneously, fattening the tail of the loss distribution and increasing unexpected losses — even without higher individual PDs.

(d) Expected loss is the *mean* of the distribution. Actual losses in any given year can far exceed the mean (tail risk). Capital is needed for the unexpected excess.

Answer Key (continued)

Exercise 5:

(a) CET1 ratio = 220/2000 = **11.0%**. CAR = (220+40+60)/2000 = 320/2000 = **16.0%**.

(b) Combined CET1 requirement = 10.0%. Bank has 11.0%. **Yes**, meets all requirements with a 1.0% buffer.

(c) New combined CET1 = 4.5 + 2.5 + 2.5 + 2.0 = 11.5%. Additional CET1 needed = (11.5% − 11.0%) × **$**2,000M = 0.5% × **$**2,000M = **$10M**.

(d) G-SIBs pose systemic risk: their failure could destabilize the global financial system. Higher capital requirements create larger loss-absorption buffers and reduce the probability of taxpayer bailouts. The surcharge also incentivizes banks to reduce their systemic footprint.

Exercise 8:

(a) Alpha: RWA/Assets = 25/50 = 50%. Beta: 35/50 = 70%. **Beta has a riskier asset mix** — more of its assets carry higher risk weights.

(b) **Alpha is more resilient**: (1) Higher stressed CET1 (8.5% vs. 5.2%). (2) Higher LCR (145% vs. 105%). (3) Lower NPL ratio (1.2% vs. 3.8%). (4) NSFR above 100% (112% vs. 92%).

(c) Beta's 10% CET1 drops to 5.2% under stress (breaching 7% buffer), its NSFR is below 100% (structural funding risk), NPL ratio is elevated at 3.8%, 52 hours of IT outages signal weak operational controls, and 65% revenue concentration in 3 sectors creates material concentration risk.

(d) Alpha preferred. For Beta, a premium of 50–100 bps is justified due to stress test vulnerability, structural funding weakness (NSFR $<$ 100%), and operational risk concerns.