Questions 1 – 3 pertain to the Case Study.
Each question should be answered independently.

Question 1

Part A

GICs

- Largest component of policyholder liabilities
- Surrenders by contract holders are MVA – cuts down on disintermediation risk
- Book value withdrawals at participant level only
- Substantial percentage of assets in less liquid assets – private bonds and commercial mortgagers
- Downgrade of company may lead to run-on-the-bank
- Significant impact on company's profits if this business leaves

Group LTD

- Second biggest block of liabilities
- Also sensitive to company ratings

Variable Life

- Backed by assets in separate account, so less liquidity concern
- If market increases, variable policy loan interest rate reduces disintermediation
- But policy loan rate not on same basis assets held

Term

- Not sensitive to interest rates

Part B

- Add the following features:
  - MVA – adjust surrender value at time of surrender in relationship to change in interest rates since annuity was purchased
  - Surrender charges – grading down over 7-8 years
    - Reduces incentive to surrender when rates increase
    - Increases recovery of acquisition costs
  - Credited rate – credit an interest rate related to current market rate in order to entice policyholder to stay with company instead of leaving to get a higher rate elsewhere
  - Minimum rate guarantee
  - Variable policy loan interest rate

Part C

- Use effective duration, convexity an cash flow testing
- Establish underwriting authority and limits
- Develop standards and reports
    - Weekly summaries of asset durations
    - Allows management to monitor risk
- Develop investment guidelines and standards
- Maintain adequate supply of liquid assets

Questions 1 – 3 pertain to the Case Study.
Each question should be answered independently.

Question 2

a) Four objectives of risk management are:
Measuring risk limits
Defining risk limits
Enable management to evaluate performance
Manage shareholder capital efficiently

i) NARA's required capital formula is RAROC = profit/capital at risk
The risk adjusted return on required capital for 1999 is:
GIC (2.9) / (81.5+48.9) = 2.22%
Variable Life $(9.6)/(2.4\wedge 2+(8.8+1.9)\wedge 2)\wedge .5 = 87.54\%$
Term Insurance $(27.7)/(705.3\wedge 2+(3.2+.9)\wedge 2)\wedge .5 = 3.93\%$
LTD $(2.6)/(36.7\wedge 2+142.7\wedge 2)\wedge .5 = 1.76\%$

ii) The main factors driving these results are:
Required capital determined by NARA formula
Variable Life has low capital base
LTD has high capital charge and low profitability
Term has high capital charge relative to profitability
GIC has low margins relative to capital charge

b)

iii) Using risk adjusted return to allocate capital:
can lead to rejection of profitable opportunities where RAROC exceeds CoC
if $CoC \rangle RAROC$, can still invest in opportunities if excess capital exists

Decision based on:
whether capital shortage or excess capital exists
whether capital can be modified

RAROC allows managers to assess capital productivity across centers

c)

Three methodologies that can be used to reflect the benefits of diversification are:

1) Split diversification benefits equally over all business units:
Measures correlation between business unit returns
Easy to apply, but not necessarily correct
GIC gets large allocation relative to actual required

2) Use marginal risk capital:

Defined as reduction in capital if unit under evaluation not part of firm
Appropriate for acquisition/divestiture decisions
Some capital still unallocated

3) Assign to each unit with reference to internal beta:
Defined as ration of covariance between returns of units and total company
Consistent with capital budgeting technique
Enables firm to allocate all existing capital

3. *(13 points)* Zest is considering acquiring 100% of the shares of Tread Lightly Financial Corporation (TLFC) for a cost of 50.0. This would be financed out of retained earnings.

TLFC offers one product, a variable annuity contract with a 10 year 100% guaranteed maturity benefit with elective resets (GMAB). The product does not provide a minimum death benefit nor a minimum income benefit.

In December 2000, Zest's senior management team met with NARA to discuss the potential acquisition. NARA indicated that they plan to adjust their RBC formula by adding to the C-2 component 100% of the "Total Balance Sheet Requirement" for segregated fund guarantees using the new OSFI guidelines. NARA will apply the OSFI factors on an aggregate basis.

You are given the following information about TLFC at 31 December 2000:

FUND	Guaranteed Value	Market Value	Reinsurance Credit	MER
Money Market	3.0	3.0	0	175 b.p.
Balanced	200.0	250.0	0	225 b.p.
Aggressive Equity	2.0	5.0	0	250 b.p.
Fixed Income / Bond	50.0	37.5	0	200 b.p.

All the guarantees apply on a deposit by deposit basis.
On an aggregate basis (over all funds) the average years to maturity is 7.5 years.
Based on reliable company experience, the reset utilization rate is 100%.
For all the funds, the Time Diversification Factor is 1.0.
The "Margin Offset" is zero for all funds.

The following factors have been provided to you.

TABLE 1 – Basic Factor Table

	Money Market	Fixed Income	Balanced	Diversified Equity	Intermediate Risk Equity	Aggressive Equity
Minimum Maturity Benefit						
100% 10-year with resets	0.06%	1.00%	5.83%	13.31%	19.18%	25.79%

TABLE 2 – MV/GV and Time-to-Maturity Adjustments (Status Factor)

	Money Market	Fixed Income	Balanced	Diversified Equity	Intermediate Risk Equity	Aggressive Equity
Maturity Benefit – With Resets: (>3 Years to Maturity) 10-Year Term						
$MV / GV \geq 2.00$	0.48	0.61	0.77	0.89	0.92	0.96
$1.50 \leq MV / GV < 2.00$	0.48	0.61	0.77	0.89	0.92	0.96
$1.25 \leq MV / GV < 1.50$	0.48	0.61	0.77	0.89	0.92	0.96
$1.00 \leq MV / GV < 1.25$	1.00	1.00	1.00	1.00	1.00	1.00
$0.75 \leq MV / GV < 1.00$	100.51	9.60	2.50	1.64	1.45	1.23
$0.50 \leq MV / GV < 0.75$	420.16	29.45	5.91	3.16	2.58	1.93
$MV / GV < 0.50$	1379.11	88.99	16.15	7.73	6.16	4.38

3. Continued

TABLE 3 – MER Multiplier (Per Percentage Point Difference in MER)

Money Market, Fixed Income, and Balanced Funds	
MER Delta < 0	*MER Delta* > 0

Question 3

a)

New requirements require capital for asset guarantee on death for Zest's Variable Life line will add to Zest's C2 risk
Increases required capital component
Some benefit of correlation in RBC formula

b)

	A	B	C	D	A x B x C + D	Market Value	Capital
Money Market	0.0006	1.0000	1.4095	0.0000	0.0008	3.0	0.0025
Balanced	0.0583	0.7700	0.8160	0.0000	0.0366	250.0	9.1578
Aggressive Equity	0.2579	0.9600	0.9160	0.0000	0.2268	5.0	1.1339
Fixed Income/Bond	0.0100	9.6000	0.9325	0.0000	0.0895	37.5	3.3570
Total							13.6512

This is considered C2 risk

Additional C2 Risk = 13.6512

Capital $= SQRT(C2 \wedge 2 + (C1 + C3) \wedge 2) = SQRT((945 + 13.6512) \wedge 2 + (368 + 56.6) \wedge 2)$

1,048.474
no change to available = 2,886.5
New Capital Ratio = 275.3%

c)

Alternate hedging strategies
static hedging:
very customized options
provides only partial mitigation of market risk

dynamic hedging:
objective is to replicate liability payoffs
addresses only investment risk
flexible process
need specialized risk management
should be considered only by those companies that understand consequences

d)

Proposed changes:
reduce guarantee to, say 90%
reduces factor for "MV-GV" component
extend contract maturity to, say age 75

increases period over which deficiencies can recover
do not permit resets
eliminate availability to high-volatility funds
set guarantee to "family of funds" basis
allows guarantee to be diversified
limit size of each deposit
retain right to increase risk fees

Question 4

Maintain US Government Bonds at 30%

- No default risk and very liquid – no concerns

Reduce Current Percentage of US Corporate Bonds

- Higher return than US government bonds
- Risk levels vary between different issues
- Need expertise in credit risk evaluation and management

Add Foreign Government Bonds

- Need to consider political and foreign exchange risks, liquidity and difference in tax rules
- Political risk can be controlled by investing only in stable countries
- Foreign exchange risk can be hedged with forward/future contracts
- Need to consider counter-party risk when using forwards
- Futures are guaranteed by the exchange so there is no default risks
- Full hedging can eliminate this risk completely and allow us to take advantage of higher yields without currency exposure
- Must have expertise in foreign investing and derivatives
- Foreign investments will lead to a more diversified portfolio and thus lower risk

Add Mortgages

- Matching of assets and liabilities is an issue because mortgages have significant prepayment risk
- Can structure mortgage portfolio into segments with different prepayment risks
- Mortgages are vulnerable to defaults during economic downturns
- Mortgages backed by the US government and related agencies are virtually risk free
- Need underwriting and modeling expertise
- Improve portfolio diversification

Reduce Duration by One Year

- This will reduce exposure to interest risk
- Need to monitor duration of asset and liability to ensure close match
- Must use consistent duration measures
- As risk of default increases with time since issue overall credit risk will decrease

Question 5

a)

CC is wasting capital. Instead of capital being invested in positive NPV projects, CC is earning a low ROE and is dragging down overall company return. CC runs the risk of agency problems whereby management invests in negative NPV projects or inefficient uses of capital.

b)

Two Methods

1) Increase Dividends

CC could return cash to shareholders in the form of a dividend, thus reducing capital

Increasing dividends should increase CC's stock price due to signaling effect

A dividend increase results in a positive market reaction, although this would turn negative if the new dividend level wasn't maintained

Dividends might be disadvantageous to shareholders since dividends are taxed immediately and at a higher rate than capital gains are taxed

2) Implement a Share Repurchase Plan

CC could repurchase shares in the open market at a premium, reducing capital

Share price increases as ownership becomes more concentrated

Cash received by shareholders through a share repurchase program is considered capital gains and is taxed at a lower rate

c)

CC could utilize Assumption Reinsurance to purchase a block of SPDA's from another company. This may lower unit expenses by utilizing excess administrative capacity of existing SPDA line and through achieving critical mass. This is a pure investment of capital, providing surplus relief to the ceding company. It is a permanent transfer of all obligations with no recapture. It is more efficient than purchasing a block directly, however it would require policyholder consent and shock lapses after the transfer could be antiselective. Current capital is exchanged for future profit stream.

d)

Corporate Governance Plan

Reduce Board size to improve efficiency

The CEO and the chairman of the Board should not be the same person

The CEO should be the only insider; active, e.g. institutional investors should be recruited to serve on the board.

Board members should be required to have more of an equity stake in CC.

Board should have more financial expertise and should focus on maximizing shareholder value rather than minimizing downside risks e.g. legal.

Employee Incentive Structure

Could implement one or more of:

i) Profit Sharing Plan – employees get a variable portion of compensation ties to CC's profit each year

ii) Employee Stock Option Plans (ESOPS)
Employees' stake in CC increases over time

iii) Leveraged Equity Purchase Plans
Key managers purchase equity through their own funds plus a loan from CC

iv) Leveraged Cashouts

v) Economic Value-Added System
EVA = Net Income – Cost of Capital
Consists of (a) Cash Bonus Plan – tied to increases in EVA; put into bonus blank
(b) Leveraged Stock Options – managers must buy stock options whose exercise price increases at the cost of capital.

Question 6

a)

Appraisal Value = Fair Value of surplus plus
Embedded value of Inforce Business plus
Goodwill attributed to new business

Fair value of surplus = Fair Value of Assets – Fair Value of Liabilities

= 19,750 – 17,250

= 2,500

Embedded Value of Inforce Business = 470

Goodwill attributed to new business = 1,125

∴ Appraisal Value = 2,500 + 470 + 1,125

= 4,095

b) Capital Market Approach

Capital Market Approach....utilize broad industry wide factors of recently demutualized companies to adjust the accounting figures of company in question

Frequently, the factors used are Price/Earnings (P/E) and Price/Book (P/BV) factors

During the adjustment process, besides the above factors, capital market also accounts for various other factors

As can be seen from the P/E and P/BV ratios of recently demutualized companies, higher P/E and P/BV ratios are usually assigned to Health Insurance companies.

The implied P/E and P/BV of Redwood Capital Management are as follows:

$$P/E = \frac{3750}{250} = 15$$

$$P/BV = \frac{3750}{20{,}000 - 17{,}650} = 1.60$$

Since Birchwood is a life company, its P/E is not as high as Spruce Meadow Health.

The P/BV ratio is higher than Pine Grove and closest to Shady Maple. The P/BV is correlated positively to ROE. The statutory return on equity for Birchwood is 10.6% which is reasonable to warrant an intermediate P/BV ratio.

c) Methods of Conversion

a) Direct Demutualization
Convert to stock company and issue common stock to policyholders

Need to value the relative interests and overall value of issue of stocks

b) Stock Holding Company
Create a stock holding company and issue shares of stock holding company to policyholders

Again relative interest and overall value need to be assessed

Mutual Holding Company
Create a mutual holding company
Issue shares of demutualized company to holding company. Policyholders given membership rights of mutual company

Valuation of entire shares but not relative shares need to be done

Stock Subsidiary Company
Create a stock subsidiary which is a holding company to a subsidiary to which policyholders are transferred

Policyholders would retain membership rights via the mutual company without the need for allocating stock to each policyholder

Question 7

$R_b = 12\%$ $R_b^{rp} = 5\%$ $\Rightarrow R_B^{RA} = 7\%$

$g = 40\%$ $R_a = 16\%$ $R_a^{rp} = 10\%$ $R_A^{RA} = 6\%$

r*=4.9%

B=2 $R_S = 30\%$

$t_B = 30\%$ $t_S = 20\%$

Comparison by Tax Rate:

	Fully Taxable	Partially Taxable	Tax Exempt
$\frac{R_A^{RA} - r^*}{R_B^{RA}} = Explicit\ Tax$	$\frac{7-4.9}{7} = 30\%$	$\frac{6-4.9}{7} = 15.7\%$	$\frac{4.9-4.9}{7} = 0\%$
$\frac{R_B^{RA} - R_A^{RA}}{R_B^{RA}} = Implicit\ Tax$	$\frac{7-7}{7} = 0\%$	$\frac{7-6}{7} = 14.3\%$	$\frac{7-4.9}{7} = 30\%$
$\frac{R_B^{RA} - r^*}{R_B^{RA}} = Total\ Tax$	$\frac{7-4.9}{7} = 30\%$	$\frac{7-4.9}{7} = 30\%$	$\frac{7-4.9}{7} = 30\%$

Comparison on Return Provided:

Fully Taxable $(R_B - R_B^{rp})(1-gt) = 7\%(1-30\%) = 4.9\%$ risk adjusted

$12\%(1-30\%) = 8.4\%$ = non-risk adjusted

Partially Taxable $6\%(1-.4(.3)) = 5.28\%$ risk adjusted

$16\%(1-.4(.3)) = 14.08\%$ non-risk adjusted

Tax Exempt 4.9% both risk & non-risk adjusted

Growth Stock
$CAPM\beta = 2$
Risk Premium = β (Market Growth Rate – Risk Free)

= 2 (.15-.049)

= 20.21%

Risk Adjusted Pretax Return = 30% - 20.2%

= 9.8%

Risk Adjusted Return after Tax = 6.9%

a)

Comparison by Riskiness

	Risk Premium (pre-tax)	$R^{rp}(1-gt) = r^{rp}$ Risk Premium (after tax)
Fully Taxable	5%	3.5%
Partially Taxable	10%	8.8%
Tax Exempt	0%	0%
Growth Stock	20.2%	14.1%

Should compare by after tax risk premium

Risk: stock>partially taxable>fully taxable>tax exempt

b)

John would pay $385,000 in taxes with no strategy

.25 ($100K) + .4($900K)= $385K = 38.5% effective tax rate

John could issue a fully taxable bond that pays 12%.

Face should be $\frac{1{,}000{,}000}{.12} = \$8.33$ million

The bond interest payments will amount to $1 Million of deductible interest so that will offset his salary.

John would then take the $8.33 Million and invest in the partially taxed bonds which yield a risk adjusted after tax rate of 5.28% (which is higher than the no risk, tax free yield of 4.9%).

Pre-tax the return is 16% and only 40% is taxable. The income would be $1.3333M, and would be taxed at a (.3)(.4) = 12% tax rate.

c)

Limitations on the Arbitrage Opportunities

Law may restrict this investment strategy

John may not be able to borrow at the same rate he can lend

Transaction costs and other frictions could prevent arbitrage

Question 8

The REMM's choices depend on which of these items they prefer
They are willing to make tradeoffs for the right price
They will be resourceful and try to get by on less of one item to have more of one he wants
They can never be satisfied; he always wants more of something

Assume our REMM values entertainment over insurance and charity and pensions, he may choose:

Shelter	$70
Food	$40
Entertainment	$20

The REMM values his entertainment more with sufficient food and shelter; others may not

The Political model of humankind says people are perfect agents and will act to benefit society as a whole, so they will put charity high on the list:

Charity	$15
Insurance	$20
Pension	$0
Shelter	$70
Food	$25
Entertainment	$0

The psychological model says needs have to be met in order of survival need, with no tradeoffs:

Food (and water) first, then safety, then love, then self actualization.

All money would go for food and shelter

Food	$50
Shelter	$80

Question 9

a)

Techstar –
Does not recognize cost of capital
Will be affected by management sandbagging
Want steady increasing EPS
Cash bonus is short term oriented with limited upside potential

Megahold –
Use of EVA recognizes cost of capital
EVA = net income – cost of capital
Incentives aligned with stockholders
Upside is unlimited and there is also downside
LSO make ownership real so it is long term and value oriented
Purchase stock option in the money and set exercise price so that it reflects its cost of capital
Use is consistent across business units allows collaborative growth
A portion of compensation is deferred

b)

Megahold's agency costs should be higher since it's a more widely held company, senior management holds a smaller percentage of equity and it has a higher leverage ratio.
Megahold's bonus plan should help reduce agency costs
Agency costs between bondholders and stockholders grows worse as leverage rises
Few stockholders have incentives to monitor managers
Debt service payments restrict access to free cash flows and can reduce some agency costs

c)

Bank loan is best option, then 30 year bond and equity is worst option
Reasons for choosing bank first:
Will have positive impact on stock price because public recognizes that banks conduct due diligence and having a loan approved is like a seal of approval
Other advantages: possible lower cost of borrowing, maintain confidentiality, can prepay loan without penalty, easier to renegotiate, no regulatory issue cost, more flexibility since only one counterparty
30 Year bond:
principal repayment being inversely related to public rating is very risky; not a good risk management element because it will have to pay more principal when it can least afford it and will increase likelihood of bankruptcy
may have slightly negative stock price reaction
considered a 'hybrid debt'
maturities are longer and no amortization of principal
less restrictive covenants

Equity:
Issue if management thinks shares are over-valued
Usually negative impact on stock price as investors feel management exploiting inside information
Can be overcome by announcing stated use of funds
Currently undervalued so equity issued as a last resort

d)

Methods to market equity:

1) Rights vs. Underwritten
   Rights: existing shareholders get warrants
   Underwritten: sell to investment bank who sells to public
   Most use underwriters
2) Negotiated vs. Competitive Bid
   Competitive bids mainly used by regulated firms
   Others mainly choose negotiated offers
   Problems with confidentiality for competitive bids
   Issue costs for competitive bids have higher variance
3) Shelf vs. Traditional Registration
   Shelf: can register with SEC to issue more shares over 2 years on the same filing and has added flexibility
   Investors want larger discounts for this added flexibility since it allows management to exploit inside information

e)

Weakness in DCF:
Hard to estimate future cash flows
Heard to estimate discount rate
Hard to estimate cross sectional impact on cash flows
Biased to positive outcomes
Biased against longer term projects

Improvements:
Consider real options created by investing in Techstar
Techstar has significant growth options and intangible assets (R&D) which are not easily valued using DCF
Investment may create growth options and other options such as staging, flexibility, learning, timing and exit

Question 10

a)

Lender A min ROE = 5% $\quad \Pr(ROE > 5\%) \geq 95\%$

Elmwood's current leverage ratio, $h = \frac{500-375}{500} = 0.25$

Given: $SD(ROE) = 6\%$, $\quad E(ROE) = 15\%$

$$SD(ROE) = \frac{SD(ROA)}{1-h} \qquad E(ROE) = \frac{E(ROA) - hi}{1-h}$$

$$15\% = \frac{E(ROA) - 0.25(7.5)}{0.75}$$

$\therefore SD(ROA) = 6\%(0.75)$

$= 4.5\%$ $\quad E(ROA) = 13.125\%$

i = after tax interest rate = 10% (0.75) = 7.5%

Elmwood's firm line: $ROE = 7.5 + \left(\frac{15-7.5}{6}\right)SD$

$= 7.5 + 1.25$ SD

Lender's A shortfall line: ROE = 5 + 1.645 SD

$\therefore 7.5 + 1.25\,SD = 5 + 1.645\ SD$

$0.395\ SD = 2.5$

$SD = 6.329\%$

$\frac{SD(ROA)}{1-h} = 6.329 = \frac{4.5}{1-h} \Rightarrow h = 0.289$

$\therefore$ *maximum leverage* = 28.9%

Therefore, with a current amount of debt of only 25%, there is only a marginal amount of excess debt capacity remaining with Lender A.

b)

Lender B: pre-tax rate = 18%
After tax rate = 18% (0.75) = 13.5%

$\Pr(ROE>0) \geq 80\%$

$\therefore$ *shortfall line*: $ROE = 0 + 0.842\ SD$

before borrowing from B,

Elmwood's h = 0.289

$$\Rightarrow E(ROE) = \frac{E(ROA) - hi}{1-h}$$

$$= \frac{13.125 - 0.289(7.5)}{0.711}$$

$$= 15.411$$

$$SD(ROE) = 6.329$$

$$\text{New firm line} \Rightarrow ROE = 13.5 + \left(\frac{15.411 - 13.5}{6.329}\right) SD$$

$$= 13.5 + 0.302\ SD$$

$$\therefore 0.842SD = 13.5 + 0.302SD$$

0.54 SD=13.5

SD = 25%

$$\frac{SD(ROA)}{1-h} = 25\% = \frac{4.5\%}{1-h} \Rightarrow 1-h = 0.18$$

$$h = 82\%$$

∴ Elmwood can borrow from Lender A first until its leverage ratio reaches 28.9%
- Elmwood will pay Lender A 10%

Then Elmwood borrows more from Lender B and pays 18%
- Elmwood cannot borrow any more when its leverage ratio hits 82%

c)

<u>For Elmwood</u>
Interest deductibility for tax purposes
How strict the covenants are and how many covenants will be present
Its investment opportunities in the future
Rating agencies don't like excessive leverage

<u>For Lender A</u>
Nature of Elmwood's assets
→ potential for recovery if bankrupt
→ prospect for rating improvement
volatility of Elmwood's cash flow

d)

Elmwood should borrow to the maximum it is allowed to borrow from Lender A, since A charges a much lower rate than B. Therefore max out the leverage ratio with A at 28.9%.
This will increase Elmwood's total liabilities to $375 + 0.289\,(500) = 519.5$ mil
If Elmwood feels that it needs more capital, then it can borrow from Lender B, but the CFO should not recommend that.
Increasing leverage has negative impact on ratings because excessive leverage increases probability of default.

Question 11

a)

1.

Liquidity Risk Analysis

Risk of a funding crisis

The company is taking on risks similar to General American Life
Compare the liquidity of the assets to the liquidity of the liabilities
Put feature means that liabilities are very liquid
Understand what the potential liquidity needs could be given a major event which would result in a run on the bank

2.

Credit Risk Analysis

Risk of default on assets

Significant since the company invests in low-grade debt
Look at the adequacy of due diligence done
Look at exposure limits by industry, geographic region, business, company
Create a probability based migration model as laid out in CreditMetrics

3.

Systematic/Interest Rate Risk Analysis

Risk of the company's vulnerability to interest rate variation

Since liabilities are fixed rate and assets are fixed income, interest rate shifts can have a major impact on the company
Analyze impact of interest rate shifts on the embedded options in both the assets and liabilities
Rising interest rates could result in disintermediation risk and result in a run on the bank

Falling interest rates could result in reinvestment risk
Should perform detailed stochastic analysis

b)

Risk Based Capital

C1 Factor could be quite high

Lower rated debt has high risk factors
Level of diversification has an impact

C3 Factor should not be that high

Does not take into account embedded options

Rating Agencies
Rating agencies has similar but more sophisticated techniques as compared to RBC
They attempt to capture the embedded options in the assets
Callable bonds and CMO's may hurt the rating

Rating agencies review the product characteristics
May recognize risk factors inherent in the product like a "run on the bank" which are not picked up by RBC

Rating agencies look at the liquidity of investments relative to liabilities which may be an issue

c)

New C-3a component will require the company to perform specified cash flow testing under given scenarios
The component will be the weighted value of the deficits that occur

The new C-3a component should result in a higher capital charge
The company's investments have embedded options
The product put option will have an adverse impact

d)

Reinsurance
One or more risks are transferred to a reinsurer
Company would receive a ceding allowance from reinsurer covering expenses and future profit margins
Ceding allowance increases available surplus

Must satisfy regulators that the transaction involves full risk transfer to an authorized reinsurer to get desired treatment
Will reduce RBC risk components as risks have been reduced
Will increase TAC
Result is higher RBC ratios

Must satisfy rating agencies that genuine risk transfer has occurred
Rating agencies will look at the financial strength of the reinsurers
Should have a favorable impact

Question 12

a)

CreditMetrics is a tool for assessing portfolio risk due to changes in debt value caused by changes in obligor credit quality

Changes in value include not only changes caused by possibility of default events, but also upgrades and downgrades in credit quality.

Determine probability distribution of changing rating based on historic performance

Determine value of bond at each rating based on historic performance.

Determine value of bond at each rating by discounting at forward rate for each rating.

Combine distribution and value to determine probability distribution of bond value

With portfolio, can us combinatorics or simulations to determine probability distribution of portfolio.

Can run Monte Carlo simulation to obtain distribution of values at different credit ratings

Determine VAR, using percentile method, or standard deviation of distribution

Recommend percentile method due to large down-side tail of the distributions.

b)

We want to estimate X such that: $\Pr(Value < X) = 0.05$

i. First we calculate one-year forward rates, using the formula:

$$_2f_1 = \frac{(1+S_2)^2}{(1+S_1)} - 1$$

We get:

AAA	4.70
AA	4.75
A	4.90
BBB	5.30
BB	6.50
B	8.01
CCC	15.00

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STOP

ii.

Next we calculate the probability density and cumulative distribution of values of bond at the end of the year.

Year-end Rating	Probability of State	Cumulative Probability	New Bond value plus coupon
Default	0.98	0.98	50.00
CCC	0.96	1.94	96.30
B	6.87	8.81	102.21
BB	84.61		
BBB	6.09		
A	0.40		
AA	0.06		
AAA	0.03		

From the above table we see that **X = $102.21. This is the required answer.**

Question 13

$tpo = 28\%$
$tco = 35\%$
$Rpen = 10\%$
$r_c = 6\%$
${}_{45}P_{65} = 95\%$

i)

$$\frac{1-tco}{(1-tpo)(1+Rpen)^n} \quad {}_{45}P_{65}\,(10)\,(\#\text{ of ee})$$

$$\frac{(1-35\%)}{(1-28\%)(1+10\%)^{20}}\,(.95)(10) = \$1.2748$$

1.2748 for all ee's

.12748 for each one

ii)

$$\frac{(1-tco)}{(1+r_c)^n}\,{}_nP_x =$$

$$\frac{(1-35\%)}{(1+6\%)^{20}}\,(.95) = .1925 \text{ for each}$$

$$= 1.925 \text{ for all}$$