1. **Learning Objectives:**
   1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations.

**Learning Outcomes:**
(1a) Assess the different types and combinations of investment vehicles for providing retirement benefits given the particulars of the stakeholders’ financial circumstances, philosophy, industry, work force and benefit package.

(1b) Distinguish the various strategies, approaches and techniques used to manage retirement fund assets.

(1e) Describe the regulatory restrictions on retirement plan assets.

(1f) Identify and assess the sources of investment risk applicable to retirement fund assets.

**Sources:**
Study Note: RPIRM-103-15

**Commentary on Question:**
The question was answered well by most candidates. Some candidates lost marks for not providing sufficient details on why the specified fiduciary duties were violated in part b)

**Solution:**
(a) List the fiduciary duties of a pension plan trustee.

The trustee of a retirement plan trust has the following duties:

1. The Duty of Loyalty
2. The Duty of Care
3. The Duty to Diversify Plan Assets
4. The Duty of Impartiality
5. The Duty to Delegate
6. The Duty to Follow Statutory Constraints (Avoid Prohibited Transactions)
7. The Duty to Make the Property Productive
8. Duties Regarding Co-Trustees
9. The Duty to Act in Accordance with the Trust Agreement
1. Continued

(b) Describe the fiduciary duties that the CIO could be violating with this investment.

The following are the possible duties that the CIO could be violating:

1. **The Duty of Care**: The CIO has only just started investing in artwork. He has limited experience and taking 90% of the assets does not seem to satisfy the “prudent man” standard.

2. **The Duty to Diversify Plan Assets**: Taking 90% of the plan’s assets to invest in art work does not allow for diversification which leads to uncompensated risk.

3. **The Duty to Follow Statutory Constraints (Avoid Prohibited Transactions)**: Many jurisdictions have statutory constraints on investments and transactions that can be made by trustees of a retirement plan trust. For example, certain types of trusts cannot acquire or hold collectibles (paintings, expensive rugs, etc.). CIO should consider whether this transaction is prohibited.

4. **The Duty to Make the Property Productive**: This is a general duty of trustees, which in the retirement plan context merely means that the prudent investor should seek a reasonable return on the investment. Prudence is not satisfied merely by preserving capital and avoiding losses. The CIO wanting to invest in artwork to avoid losses does not lead to the investment being productive.
2. Learning Objectives:
2. The candidate will recognize and appropriately reflect the role of plan investments in retirement plan design and valuation.

Learning Outcomes:
(2d) Apply and evaluate strategies and techniques for asset/liability management.

Sources:
Study Note(s): RPIRM-136-15, RPIRM-140-16

Commentary on Question:
The question was meant to test the candidate’s understanding of the features of three different risk mitigation strategies for defined benefit pension plans. It was also meant to test the candidate’s ability to evaluate the appropriateness of these strategies in a simple business context.

Solution:
(a) You are the actuary for Company ABC, which sponsors several defined benefit pension plans. Company ABC’s new CFO would like to learn more about the following risk mitigation strategies:

- Buy-in annuity contracts;
- Longevity swap contracts; and
- “q-forward” contracts.

Describe each of the above strategies.

Buy-in annuity contract
Pension Plan purchases a group annuity investment contract to match the obligations or a subset of the obligations. The interest rate, investment and longevity risks are transferred from the pension plan to the annuity carrier. Such contracts reduce the size of the pension plan in economic terms, but not necessarily in accounting or regulatory terms as a buy-in contract does not remove the pension assets or the liabilities from the sponsor's balance sheet. A buy-in annuity contract also allows sponsors to avoid the large up-front payment that may be required in a buyout for plans that are underfunded.

Longevity swap contract:
The pension plan enters into a contract where it receives the actual payments it must make to pensioners and makes fixed payments to the counter-party/hedge provider. The fixed payments from the pension plan to the counter-party/hedge provider are based on an amount-weighted survival rate. Only the longevity risk is transferred from the pension plan to the counter-party/hedge provider.
2. Continued

“q-forward” contract:
Contract involving the exchange of a future amount proportional to the actual realized mortality rate of a given population in return for an amount proportional to a fixed mortality rate agreed upon by the parties when the contract is entered. The fixed mortality rate is set when the contract is entered, and it defines the "forward mortality rates" that are used to determine the exchange of a future amount for the population in question. Only longevity risk is transferred from the pension plan to the counter-party/contract provider.

(b) Assess whether each of the above strategies align with Company ABC’s objective.

Commentary on Question:
Many candidates missed the fact that they needed to assess whether each of the strategies aligned with the CFO’s objectives but rather simply explained which risks were hedged without tying it back to the CFO’s objectives.

Buy-in annuity contract
The strategy does not align with the CFO’s objectives.

Because the annuity carrier agrees to pay the required benefit payments to the plan in exchange for an upfront premium, investment and longevity risk transferred to annuity carrier. The CFO only desires to protect against longevity risk.

Longevity swap contract:
The strategy does align with the CFO’s objectives.

The contract issuer only assumes longevity risk because the issuer agrees to pay actual pension payments in exchange for predetermined fixed payments. The plan sponsor retains investment risk, because they does not transfer all the assets up front to the issuer of the contract.

“q-forward” contract:
The strategy does align with the CFO’s objectives.

The contract issuer only takes on longevity risk, because if realized mortality rates are lower than assumed by the contract when it matures, there will be a net payment to the plan (and vice versa). The plan sponsor retains the investment risk, because the issuer does not transfer all the assets up front to the issuer of the contract.
3. **Learning Objectives:**
2. The candidate will recognize and appropriately reflect the role of plan investments in retirement plan design and valuation.

**Learning Outcomes:**
(2d) Apply and evaluate strategies and techniques for asset/liability management.

**Sources:**
RPIRM-147-17: Charting the course – A framework to evaluate pension de-risking strategies
RPIRM-152-18: Pension plan immunization strategies: How close can you get?

**Commentary on Question:**
*Commentary listed underneath question component.*

**Solution:**
(a) Explain how a liability driven investment (LDI) strategy reduces interest rate risk in a defined benefit pension plan.

**Commentary on Question:**
*To achieve full credit successful candidates correctly identified that assets and liabilities need to be considered concurrently and that both should move in tandem as interest rates move. Partial credit was given for discussing duration matching and/or cash flow matching.*

An LDI strategy will reduce the volatility of funded status of a plan by considering the characteristics of the liabilities when choosing assets. When done correctly the plan’s assets and liabilities will move in tandem for a given change in interest rates.

(b) Explain why the funded status may have decreased.

**Commentary on Question:**
*To achieve full credit successful candidates must have correctly identified that the company has attempted to hedge its accounting funded status and discuss the reasons why it is difficult to perfectly hedge accounting liabilities. Partial credit was given for the following:*
*• Stating that key-rate duration mismatch can cause deteriorating funded status*
*• Plan experience (including any financial or demographic changes, benefits, provisions, etc.)*
*• Lump sums being calculated using different interest rates than accounting liabilities*

*No credit was given for stating that DEF’s existing LDI strategy was not created correctly.*
The yield curve used to determine accounting liability discount rates are based on high quality corporate bonds which creates an un-investable target for the LDI strategy. This is due to the fact that the risk of downgrades and/or defaults in corporate bonds is not present (or at least very different) in the liabilities. There is a limited supply of high quality corporate bonds in which to invest assets leading to a less than ideal hedge against accounting liabilities.

(c) Describe two other solutions available to Company DEF to reduce funded status volatility.

**Commentary on Question:**
To achieve full credit successful candidates must correctly identify two alternative strategies to traditional LDI, described how they work and explain why they reduce funded status volatility.

Many candidates focused on fixing the plan’s current LDI strategy rather than providing alternatives. For example any responses discussing better effective duration matching, key-rate matching, ALMs, glide paths / journey plans, increasing equity/infrastructure/real estate content, changing the plan design, etc. No credit was given for these types of answers as they either miss the intent of the question or do not actually reduce funded status volatility more than the company’s current strategy.

The solution outlined below is one set of acceptable alternatives; others include Annuity Buy-In, Derivative Overlay and Interest Rate Swaps.

1. Insured LDI
   a. Provides a guaranteed investment that exactly matches the economic basis of the liabilities
   b. This strategy eliminates the basis risk that exists between traditional LDI and the discount rate used to calculate plan liabilities

2. Annuity buy-out
   a. Involves transferring the existing pension liabilities directly to an insurer in exchange for an up-front payment
   b. This removes the liability from the plan sponsor’s balance sheet and therefore eliminates funded status volatility
4. **Learning Objectives:**

1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations.

**Learning Outcomes:**

(1f) Identify and assess the sources of investment risk applicable to retirement fund assets.

**Sources:**

RPIRM-104-15 Section 6.8 page 761-766

**Commentary on Question:**

*This question tests the candidate’s knowledge on fixed income investing. Most candidates did well in parts a) and b) of the question. To receive full mark on part c), candidates should explain the four component of management effect, including an explanation on how they are being determined.*

**Solution:**

(a) Company GHI is considering increasing the fixed income allocation in their defined benefit pension plan. The CEO of Company GHI made the assertion that fixed income investments are always less risky than equity investments.

The CEO’s assertion is not always correct. Fixed income investments are generally viewed as more predictable than equity investments, but they are exposed to very different risks than equity investments. Fixed income does have its own risks and they include:

1. Interest risk (if interest rate rises, the value of bond will fall)
2. Reinvestment risk (if interest risk fall, the coupon and principal may be reinvested at a lower rate)
3. Liquidity risk (inability to sell the bond in the future due to a lack of trading or high bid-ask spread)
4. Default risk (the possibility that the issuer will go bankrupt and might not repay the loan)
5. Inflation risk (some fixed income pays fixed payments and it does not take inflation into consideration)
6. Duration risk (how much bond price will change as interest rate changes)
7. Credit risk (changes in credit rating of the instrument will affect bond price)
8. Currency risk (changes in value of fixed income as currency changes)
9. Sector risk (changes in sector return)
4. Continued

(b) Describe how the following factors affect the return of a fixed income portfolio:

- Change in credit quality; and
- Change in the yield curve;

Commentary on Question:
Candidates generally did well on this section

Change in Credit Quality
Rating agencies evaluate the creditworthiness of corporate bond issues, and credit quality spreads vary with changes in the required yields for fixed-income securities of a given rating.

Change in Yield Curve
The impact of interest rate and spread movements on the investment performance of a given portfolio depends upon the nature of the market changes and the interest-sensitive characteristics of the portfolio. In general, a parallel upward shift in yield curve results in a decrease in return and a parallel downward shift in yield curve results in an increase in return for a fixed income instrument/portfolio. Changes in return also depend on the change in slope of the yield curve, which may result in different impacts based on a security’s term to maturity (short-term, mid-term or long-term).

(c) The contribution of the management effect on the return of a fixed income portfolio can be decomposed into four components. Describe the four components.

1. **Interest rate management effect**
   - This measures how well the manager predicts interest rate changes.
   - Each security in the portfolio is priced as if it is a default-free security. The contribution is calculated by subtracting the return of the entire Treasury universe from the aggregate return of these repriced securities.

2. **Sector / quality effect**
   - This measures the manager’s ability to select the “right” issuing sector and quality group.
   - The return can be estimated by repricing each security in the portfolio using the average yield premium in its respective category. A gross return can be then calculated based on this price. The return from the sector/quality effect is calculated by subtracting the external effect and the interest rate management effect from this gross return.
4. Continued

3. **Security selection effect**
   - This measures how the return of a specific security within its sector relates to the average performance of the sector.
   - The security selection effect for each security is the total return of a security minus all other components. The portfolio security selection effect is the market-value weighted average of all the individual security selection effects.

4. **Trading activity**
   - This measures the effect of sales and purchases of bonds over a given period.
   - It is calculated as the total portfolio return minus all the other components.
5. **Learning Objectives:**

1. The candidate will understand how to analyze the issues facing retirement plan sponsors regarding investment of fund assets and make recommendations.

3. The candidate will understand how to evaluate the stakeholders’ financial goals and risk management with respect to their plan.

**Learning Outcomes:**

(1e) Describe the regulatory restrictions on retirement plan assets.

(3c) Analyze how the retirement plan integrates with the sponsor’s overall financial position.

(3f) Provide advice and analysis to plan sponsors and other stakeholders regarding the mitigation of pension plan risks.

**Sources:**

RPIRM-141-16 (Chapter 9 of Recreating Sustainable Retirement: Resilience, Solvency, and Tail Risk), and

RPIRM-128-13 (The Impact of the Financial Crisis on Defined Benefit Plans and the Need for Counter-Cyclical Funding Regulations)

**Commentary on Question:**

This question sought to test candidates’ understanding of a difficulty posed by pension funding regulations, in that many are pro-cyclical to a degree that can impair the security and sustainability of pension plans and the companies that sponsor them.

To receive maximum points on parts (a) and (b), the candidate should have explained and described, respectively, the current issues and possible counter-cyclical initiatives, and not merely listed them.

Note that this question addressed a theme that was covered in two different study notes. Candidates that did well included insights drawn from both notes, not merely one or the other.

**Solution:**

(a) Explain how some current pension regulations can be damagingly pro-cyclical.

Pension regulations can be damagingly pro-cyclical when they exacerbate business cycle swings to the point of harming the financial health of pension plans, the companies that fund them, or the economy generally.

Requiring additional contributions in economic downturns is damagingly pro-cyclical because it reduces business investment and further depresses the economic cycle.
5. Continued

During economic upturns, permitting contribution holidays (or otherwise discouraging surplus additions beyond a certain limit) is damagingly pro-cyclical because it frees up capital to further drive the economic cycle, at the expense of strengthening pension plan funding when it should be easiest to do so.

Fair value accounting/market value accounting and risk-based regulations encourage the fire sale of assets in market downturns to meet risk-based funding level requirements. This is damagingly pro-cyclical as well.

(b) Identify and describe regulatory initiatives that would promote counter-cyclical funding rules for defined benefit plans.

Commentary on Question:
Candidates that did well recognized that part (b) was based on a theme outlined in the source material (RPIRM-128-13, pp. 15-22), and framed their response accordingly, including some supporting descriptions for each element of the outline.

Many candidates, however, only recalled two elements of this outline (iii) and (iv), from pp. 18-19, both of which involved initiatives related to overfunding. To receive full credit, several more ideas from the outline should have been included.

Avoid excessive reliance on current market values for purposes of setting contributions. Mark-to-market values are too volatile for use in determining contributions. Consider smoothing of spot rates for liabilities to dampen the effect.

Set minimum funding levels or targets consistent with goal of benefit security. The funding level may be set using a formula approach, principles-based approach, or risk assessment (riskier assets require higher funding margin). Funding level is also a function of other security mechanisms, like pension guarantee funds.

Allow appropriate levels of overfunding in economically good times, via more flexible tax ceilings. Allow maximum contribution or funding ceilings to be averaged/smoothed over multi-year period.

Limit contribution holidays and plan sponsor access to surplus.

Encourage stability of long-term contribution patterns through appropriate actuarial methods. The actuarial method should be transparent, with smooth and sensible contribution patterns.
5. Continued

Incorporate flexibility into funding rules to reflect overall volatility of funding valuations. Recovery periods to eliminate funding deficits should reflect the overall volatility of funding levels, i.e., if little smoothing is used, allow longer periods to amortize shortfalls. If much smoothing is used, only permit shorter periods.
6. **Learning Objectives:**

3. The candidate will understand how to evaluate the stakeholders’ financial goals and risk management with respect to their plan.

**Learning Outcomes:**

(3a) Compare the interests of plan sponsors, employees, shareholders, taxpayers and other stakeholders related to the financial management of a retirement plan.

**Sources:**

RPIRM-115-13: Pensions in the Public Sector, Ch. 9

RPIRM-123-13: Risk Management and Public Plan Retirement Systems (Appendices background only)

**Commentary on Question:**

This question focused on the candidates’ understanding of different needs and interests of stakeholders in the public plan retirement system. Candidates performed average on this question. For part a), candidates are required to describe more than one objective of each stakeholder to achieve full marks.

**Solution:**

(a) Describe the objectives of the following stakeholders in the context of a public sector defined benefit pension plan:

(i) Taxpayers;

(ii) Elected officials;

(iii) Public sector employees; and

(iv) Public sector employers.

(i) Taxpayers

- Pay the lowest taxes for the public services that taxpayers require
- Expect state and local governments to hire and retain the best public sector employees
- Tax money should be used wisely, i.e. public pension plan surplus should be minimized
- Reduce tax burden by keeping assets in the plan instead of paying out for benefits enhancement or other purposes
- Cost for public pension plan is predictable and does not impinge on other public services
6. Continued

(ii) Elected officials
- Re-election is often the primary goal
- Provide rich benefits to public servants and the best public services at the lowest cost
- Elected officials want to raid pension assets to use for other projects

(iii) Public sector employees
- Desire robust and adequate retirement benefits because many are not covered by social security system
- They do not want any negative surprises with regards to benefit levels as they approach retirement
- Want to make the least contributions for the greatest pension benefits
- Maximize overall compensation package

(iv) Public sector employers
- Balance competing needs for the funds that are required to put in the pension plan
- Costs are predictable
- Pensions have a substantial role in recruiting new employees
- Public plan is used as a tool to assist in managing public sector employees. It has a significant influence on the morale of employer’s workplace as many public sector employees believe that they have received lower pay in return for higher benefits

(b) Describe how the following changes in the funded status of a public sector defined benefit pension plan would affect the stakeholders in part (a):

(i) A decrease from 100% to 80%; and

(ii) An increase from 100% to 120%.

(i) A decrease from 100% to 80%
- Taxpayers
  - Taxes could be increased to pay for pension benefits due to insufficient cash flows
  - Other government sponsored programs may be cut to fund the pension plan
  - Intergenerational inequality results in negative opinion of government
6. **Continued**

- **Elected officials**
  - As accounting cost of a plan is often used for budgeting purposes, elected officials would have less budget for other projects due to higher expenses/accounting cost
  - Re-election concerns: Negative public opinion if funding deficit grows
  - Residents may move away due to perceived financial shortcomings in the public entity, thus decreasing public entity’s tax base
  - Generous pension benefits may be highlighted to public and put pressure on government

- **Public sector employees**
  - Employee contribution may increase to fund the pension plan
  - Decreased funded status leads to lower benefit security
  - Cost Of Living Adjustments (COLA) could be decreased
  - Future benefit increases could be reduced

- **Public sector employers**
  - Poor talent attraction, lower employee retention and engagement
  - Salaries reduced or raises cut back to fund pension plans
  - Reductions in pension benefits (annual accrual, increase ERFs, increase retirement age, increased employee contributions)
  - Elimination/reduction of COLAs
  - Work with officials to improve funded status of the plan

(ii) **An increase from 100% to 120%**

- **Taxpayers**
  - Less tax revenue may be required to collect from taxpayers
  - Taxpayers may perceive their tax contributions are not effectively used to serve the public due to overfunding of pension plan

- **Elected officials**
  - Elected officials would have more budget for other projects due to lower expenses/accounting cost
  - Re-election: positive public opinion if well-funded pension plan benefits public by reducing tax revenue

- **Public sector employees**
  - Improved benefit security
  - COLA could be increased
  - Future benefit accruals could be increased
  - Reduction in employee contribution
6. Continued

- Public sector employers
  - Better talent attraction, employee retention and engagement
  - More secured pension benefits
  - Potential benefit improvements and COLAs beyond those guaranteed in the formulas
  - May lower employee contributions or believe the current employee contribution is reasonable and should not be reduced
  - Unions would likely demand lower contributions and benefit improvements for their employees
  - Accomplish the primary duty of providing secured benefits to plan participants