Sample Study Guide – Cover Letter

The ACE manual was designed with the intent of clarifying complex text (and problems) with explanations in plain-English. This is accomplished via clear and concise summaries of each chapter, author's commentaries for the most difficult ("Greek") material, ACE original problems, and more in-depth explanations and answers to some of the problems that are in the book. The study guide has calculations and practice problems integrated with the outline to facilitate learning.

In this sample we provide a chapter from the manual, along with a page from the formula list.

We would also like to put in a plug for the ACE life and online seminars. This will be an excellent opportunity for you to enhance your understanding of the syllabus. We will walk through book examples, outline key material, walk through old exam problems, and present ACE SOA type problems. The seminar will combine similar texts so you can learn/review the syllabus in a reasonable amount of time.

Please contact us with any questions at customerservice@acemanuals.com

Chapter 4 Traditional Life Insurance (SFAS 60 and SFAS 97)

Key Concepts

- Lots of lists and formula to know
- Benefit reserve and expense reserve
- As you read, keep comparing GAAP accounting to other accounting frameworks

1) Background
   a) This chapter covers:
      i) Long duration, nonparticipating, traditional, fixed premium policies.
      ii) Examples products covered by SFAS 60
         (1) Whole life
         (2) Endowment
         (3) Term
      iii) Participating products that follow the contribution principle are covered by SFAS 120
      iv) Policies that would be covered by SFAS 60 but have a premium payment period shorter than the benefit period are covered under SFAS 97 for limited pay contracts
   b) Long duration vs. short duration
      i) Short duration provides insurance for a fixed period or short duration (e.g. Group Insurance)
      ii) Long duration contracts have features that are locked in at time of sale (Whole life with fixed premiums, or annuity with guaranteed payments)

2) Product Features
   a) Premiums -- Level premium is most common, some contracts are limited pay
   b) Benefits -- A contract will have a stated face amount that will be paid at the death of the insured. Endowment contracts will pay face if policyholder lives till end of coverage period.
   c) Non-forfeiture Values -- Commonly expressed as a cash value. Term policies usually don't have a non-forfeiture benefit.

3) Benefit Reserve Methodology
   a) Short duration contracts **à** addressed in chapter 11

   b) Long Duration Contracts
      i) Premium is recognized as revenue when due from policyholders
      ii) GAAP reserve equals the present value of future benefits less the present value of net premiums
      iii) Must accrue reserve over premium period
      iv) $Net\ premium\ =\ Benefit\% * Gross\ Premium$
         (1) $Benefit\% = \frac{PVFB_0}{PVFP_0}$
         (2) $Gross\ Premium - Net\ Premium\ =\ Loading$

      v) $Reserve_t = PV_t(Benefits) - Benefit\% \times PV_t(Gross\ Premium)$

4) Expense Recognition
   a) Short duration contracts **à** addressed in chapter 11

   b) Long duration contracts
      i) Only capitalize expenses that vary with and primarily relate to the acquisition of new business (*This is discussed in detail in chapter 3*)
      ii) Expense reserve calculation follows similar methodology as benefit reserve
      iii) Net Premium in expense reserve = Expense% * Gross Premium
      iv) $Expense\% = \frac{PVFE_0}{PVFP_0}$
      v) $Exp\ Reserve_t = PV_t(Expenses) - Expense\% \times PV_t(Gross\ Premium)$

c) Recoverability
   i) Can only defer expenses if they can be recovered from future profits
   ii) Done at initial sale or pricing
   iii) Want to ensure that that: (Benefit% + Expense%) <=1
   iv) *See previous chapter for more in-depth discussion*

5) Selection of Assumptions
   a) GAAP Assumption Eras
      i) When a product is introduced the GAAP assumptions are set, this is the start of a GAAP assumption era
      ii) Typically there is a new era when a new product is introduced or when rates change
      iii) It is possible to create a new assumption era without a new product

   b) Provision for Adverse Deviation (PAD)
      i) GAAP assumptions for SFAS 60 should be best estimate plus PAD
      ii) A PAD is used since assumptions are locked in at the time of sale
      iii) If there is a high degree of risk that actual experience will deviate from the best estimate assumption, a larger PAD should be given
      iv) If actual experience is better than best estimate assumption plus PAD, then profits will emerge through the release of PADs
         (1) If mortality rates are lower than the best estimate assumption plus PAD, then profit will emerge in relation to the net amount at risk.
         (2) If lapse rates are lower than the best estimate assumption plus PAD, then profit will emerge in relation to differences between the net GAAP reserve and the cash value.
      v) When setting PADs it is important to consider each individual assumption. It is also important to consider the conservatism of the reserve in total after combining impact of all PADs.

   c) Investment Earnings Rate
      i) Investment income assumption should be based on best estimate investment yields, net of investment expenses, plus a PAD
      ii) Consider current and historical portfolio yields, trends, and new money rates

   d) Mortality/Morbidity Rates
      i) Use best estimate assumption plus PAD
      ii) PAD of 5-10% is reasonable
      iii) Consider the risk of anti-selection (tendency of lower terminations of poor risks)
      iv) Consider internal studies and industry studies when setting mortality assumption
   e) Lapse Rates
      i) Use best estimate plus PAD
      ii) Sign of PAD can be positive or negative
         (1) For lapse-supported products, a higher lapse rate in later years will increase profitability. The PAD must therefore decrease the valuation lapse rate.
         (2) Best estimate lapse rates without a PAD may be appropriate for certain products
   f) Expenses
      i) Refer to chapter 3 for categorization of assumptions
      ii) Expenses such as commissions don't need a PAD since there is no risk of adverse deviation
   g) Taxes
      i) Premium tax is considered a maintenance expense since it is a level percent of premium
      ii) All examples in this chapter ignore FIT

6) Lock-in of Assumptions
   a) Assumptions used to determine <u>benefit and expense reserve</u> are locked in at time of sale
   b) Assumptions can only be unlocked if there is a loss recognition event

7) Loss Recognition
   a) Loss recognition is done periodically throughout the life of the policy to ensure that deferred expenses can be recovered from future profits
   b) If best estimate assumptions plus PAD are not conservative enough to cover actual experience, a loss recognition event may occur
   c) Test of premium deficiency
      i) Test: GPV > GAAP Reserve - DAC
      ii) If this test is **true** then there is a premium deficiency, requiring an immediate charge to income
      iii) Premium deficiency = (a) – (b)
         (1) (a) = Gross premium valuation = $PVFB_t$ - $PVFP_t$
         (2) (b) = Net GAAP Liability = GAAP Reserve - DAC
   d) Grouping for loss recognition varies by company
      i) Loss recognition can be done at the line of business level
      ii) Policies can be grouped by GAAP assumption era
      iii) Policies that have a similar manner of acquiring, servicing, and measuring profitability can be grouped together
   e) When testing for a premium deficiency should use best estimate assumptions
   f) Order of adjustments if there is a premium deficiency
      i) Remove PAD from assumptions
      ii) DAC is decreased
      iii) If a premium deficiency still exists, a premium deficiency reserve is added such that the GAAP liability equals the GPV

Remember that GPV is calculated using best estimate assumptions and gross premium. The GAAP liability is calculated using best estimate assumptions plus PAD and net premium, so the GPV should be less than the GAAP liability.

8) SFAS 60 Numerical Examples

You should work through these examples and be comfortable with the calculations. I've made some comments on the examples that I think will be confusing on your first time through.

   a) Table 4-3
      i) The expense reserve is negative since it includes maintenance and acquisition expenses
      ii) Expense% = 0.2240 = PV(Expenses) / PV(Premiums) @ time zero
      iii) Benefit% = 0.6837 = PV(Benefits) / PV(Premiums) @ time zero

   b) Table 4-7
      i) Profit as a percent of premium increases each year since PADs are conservative
   c) Table 4-11
      i) There's a loss recognition event in year 6
      ii) Use best estimate assumptions without PAD after loss recognition event

9) SFAS 60 Examples – 20 Year Term
   a) Term insurance with ART premiums can create unusual reserves
   b) If the slope of the ART premiums is higher than the slope of the reserving mortality, this can create negative reserves
   c) A Spike in lapse rates when premium is increased can distort both benefit and expense reserves

10) Limited Payment Contracts
    a) SFAS 97 limited pay applies to traditional contracts where the mortality risk extends beyond the time period in which premiums are collected
        i) Examples are single pay whole life, and life paid up at 65 contracts
    b) Similar to SFAS 60 except
        i) Profits emerge as a level percent of insurance in-force plus the release of PADs
        ii) A deferred profit liability (DPL) is established and is amortized in proportion to insurance in-force
    c) Formulas
        i) $GAAP\ Book\ Profit\ (PreDPL) = Premium + Inv\ Inc - Benefit - Expenses + \Delta Benefit\ Reserve + \Delta Exp\ Res$

        ii) $K^{DPL} = \frac{PV_0(Book\ Profit)}{PV_0(BOY\ Ins\ Inforce)}$

        iii) Calculation of DPL -- Retrospective Method
            (1) $DPL_t = (DPL_{t-1} - BOY\ Ins\ Inforce_t \times K^{DPL}\%) \times (1 + t) + Book\ Profit_t$

        iv) Calculation of DPL -- Prospective Method
            (1) $DPL_t = K^{DPL}\% \times PV_t(BOY\ Ins\ Inforce) - PV_t(Book\ Profit)$

11) Limited Payment Example
    a) Table 4-16
        i) Column 30 (GAAP profit) is the amortization of the DPL
        ii) 15.04 = PV_0(GAAP Book Profit) * 1000 / PV_0(Insurance in-force)
        iii) Profit Per Unit = 15.04 * 1.07

12) Participating Contracts
    a) If dividends are distributed according the contribution principle, see SFAS 120
    b) If distribution of profit is not restricted, include dividends in the benefit reserve (treat it just like death and endowment benefits)
    c) If distribution of profit is restricted, then set up a UPPEA to ensure that profits will eventually be returned to the policyholders

    d) Table 4-17
        i) $UPPEA_t = UPPEA_{t-1} + Interest_t + Contribution_t$
        ii) $Contribution = Pretax\ Income - To\ Shareholders - Dividends\ Paid$

    e) Table 4-18 (UPPEA on an after-tax basis)
        i) $UPPEA_t = UPPEA_{t-1} + Interest_t + Contribution_t$
        ii) $Contribution = After\ tax\ Income - To\ Shareholders - Dividends\ Paid + Tax\ on\ Div$

13) Indeterminate Premium Products
    a) If not covered by SFAS 97 for UL type contracts then covered by SFAS 60
    b) When premiums are adjusted, assumptions may be unlocked
    c) If assumptions are adjusted should be done prospectively without change to liability as of the valuation date.
        i) $V_t = PVFB_t - PVFP_t$
        ii) After assumptions and premiums have been updated, solve for the level% so the reserve remains unchanged
            (1) $V_t' = PVFB' - GP_t' \times level\% \times Annuity\ Factor_t'$
        iii) Same concept applies to expense reserve
        iv) Need to do loss recognition testing to ensure an appropriate level%

14) Implications of Reserve Formula Selection
   a) This chapter has given guidance on how to calculate terminal reserves, in reality an actuary will most likely calculate a mid-terminal or mean reserve for reporting purposes
   b) This section gives recursive formulas, final benefit reserve formulas, and mid-terminal benefit reserve formulas
   c) Benefit Reserves
      i) Recursive formula

$$TBR_t = \frac{(TBR_{t-1} + NP)(1+i) - DB \times q_x \times (1+i)^{1/2} - CV_x(1-q_x) \times q_w}{(1-q_x)(1-q_w)}$$

      ii) Final Benefit Reserve

$$FBR_t = \frac{(TBR_{t-1} + NP)(1+i) - DB \times q_x \times (1+i)^{1/2}}{(1-q_x)}$$

      iii) Mean Benefit Reserve
         (1) $\frac{1}{2}TBR_{t-1} + NP + TBR_t$

         (2) $\frac{1}{2}TBR_{t-1} + NP + FBR_t$

   d) Expense Reserves
      i) Recursive formula

$$TER_t = \frac{(TER_{t-1} + Expenses - NP)(1+i)}{(1-q_x)(1-q_w)}$$

      ii) Final Expense Reserve

$$FER_t = \frac{(TER_{t-1} + Expenses - NP)(1+i)}{(1-q_x)}$$

      iii) Mean Expense Reserve
         (1) $\frac{1}{2}TER_{t-1} + Expenses - NP + TER_t$

         (2) $\frac{1}{2}TER_{t-1} + Expenses - NP + FER_t$

Should expense reserve be negative or positive? The book examples show a negative expense reserve, however these formulas would produce a positive value because the expenses have a "+". I think it is OK to think about an expense reserve as being the same thing as DAC, just on the opposite side of the balance sheet.

Practice Question

ABC life has recently introduced and sold a 3-year term life insurance policy. Assume the contract has following characteristics:

- Premiums are fixed and guaranteed
- No lapses
- Premium per unit = 1.25
- ABC has sold one 100,000 policy to a 36 year old.
- ABC chooses to use a PAD of 10% on the base mortality assumption
- Maintenance expenses of 0.05 per unit

Company experience on 3-year term block:

Age	Mortality per 1000
34	0.690
35	0.800
36	0.920
37	1.060
38	1.220

Industry experience on 3-year term block:

Age	Mortality per 1000
34	0.580
35	0.750
36	0.960
37	1.150
38	1.400

(a) What is the appropriate SFAS accounting treatment?

(b) Describe assumptions necessary to calculate benefit and expense reserve

(c) Calculate benefit reserve at the end of year 1

Answer

(a) Should use SFAS 60 since the term policy is a traditional contract with premiums that are fixed and guaranteed

(b) Types of assumptions

1. Investment Earnings Rate
    - Investment income assumption should be based on best estimate of investment yields net of investment expenses
    - Should consider current and historical portfolio yields, trends, and new money rates
    - Should include a PAD
2. Mortality/Morbidity Rates
    - Should use best estimate assumption plus PAD
    - PAD of 5-10% is reasonable
    - Should consider the risk of anti-selection
3. Lapse Rates
    - Should use best estimate plus PAD
4. Expenses
    - Should categorize expenses into the following classifications: Deferrable Acquisition, Non-Deferrable Acquisition, Direct Maintenance, Investment Expense, Future Utility Expenses, and Overhead.
5. Taxes
    - Premium tax is considered a maintenance expense and should be included in the expense reserve

(c) Calculate benefit reserve at the end of year 1

Age	**Mortality per 1000**
34	0.690 * 1.10 =0.759
35	0.800 * 1.10 = 0.880
36	0.920 * 1.10 = 1.012
37	1.060 * 1.10 = 1.166
38	1.220 * 1.10 = 1.342

First, calculate the reserve per 1000 of insurance

Time	$Reserve_{BOY}$	Gross Premium	K	i	Benefits	$Reserve_{EOY}$
1	0.00000	1.25	87.17%	7.0%	1.012	0.15390
2	0.15390	1.25	87.17%	7.0%	1.166	0.16458
3	0.16458	1.25	87.17%	7.0%	1.342	0.00000

PV_0(Prem)	3.5100
PV_0(Ben)	3.0597
Ben%	87.17%

Benefit% = PV_0(Benefit) / PV_0(Premium)

$Reserve_{EOY}$ = [$Reserve_{BOY}$ + (Gross Premium * K)] * (1+i) – Benefits
$Reserve_1$ = [0.00 + (1.25 * 0.8717)] * (1.07) – 1.012 = 0.15390

Now that the per 1000 reserve has been calculated, calculate the units in-force and the reserve after decrements.

Time	Survival Fact BOY	Mort Rate	Survival Fact EOY
1	1.000000	0.001012	0.998988
2	0.998988	0.001166	0.997823
3	0.997823	0.001342	0.996484

Time	Reserve Per 1000	Units In-force	Reserve After Decrements
1	0.15390	99.89880	15.37464
2	0.16458	99.78232	16.42192
3	0.00000	99.64841	0.00000

Notice that the question didn't include an interest rate. On an exam you may not receive an assumption or you may not be able to calculate an assumption. Either way, it is important that you assume an interest rate and inform the grader of your assumption. Mortality should be best estimate plus PAD, company experience on the 3-year term block is a better estimate than industry data. Calculate the year one reserve before the second year premium is paid and after the year 1 benefit is paid.

Section G: Formula List and Practice Problems

LFV Formula List

Writing down the formulas on exam day is a key aspect of getting the maximum amount of points. This formula list is a compilation of some of the important formulas on the syllabus. This list is meant to help facilitate memorization and should not be considered to include every formula in the syllabus. Please add or delete formulas as appropriate per your personalized study strategy.

Section A: Statutory and Tax Accounting Frameworks

VLIL Chapter 1

Gross Premium Valuation

$$_tV = PV_t(Benefits) - PV_t(Gross\ Premium)$$

VLIL Chapter 2 (US Only)

Successive equation

EOP Value = BOP Value + Increases – Decreases

$$Surplus_t = Surplus_{t-1} + NI - Shareholder\ Dividends +/- Other\ Changes$$

Cash Flow Statement

$$Cash_t = Cash_{t-1} + Cash\ from\ operations + Cash\ from\ invest + Cash\ from\ financing$$

Analysis of Increase in Reserve

$$Reserve_t = Reserve_{t-1} + Net\ Prem + Tabular\ Int - Tabular\ Cost +/- Other\ Changes$$

VLIL Chapter 5 (US Only)

NLP Reserve

$${}^{m}_{t}VB_{[x]:n} = AB_{[x]+t:n-t} - {}_{m}PB_{[x]:n} * \ddot{a}_{[x]+t:m-t}$$

$$= PVFB_t - PVNP_t$$

$$= PVFB_t - (PVFB_0 / PVGP_0) * GP_{x+t} * \ddot{a}_{[x]+t:m-t}$$

Modified Reserve

$$= {}^{m}_{t}VB_{[x]:n} - {}^{m}_{t}VE_{[x]:n}$$

$$= {}^{m}_{t}VB_{[x]:n} - EA * (\ddot{a}_{[x]+t:m-t} / \ddot{a}_{[x]:m})$$

$$= A_{[x]+t:n-t} - ({}_{m}P_{[x]:n} + EA / \ddot{a}_{[x]:m}) * \ddot{a}_{[x]+t:m-t}$$

FPT

Same as modified, but ${}_{m}EA_{[x]:n}^{FPT} = (AB_{[x]+1:n-1} / \ddot{a}_{[x]+1:m-1}) - c_{[x]}$

CRVM

Expense allowance = the lesser of

The EA under the FPT method for the plan of insurance

The EA under FPT for a 20-pay life contract (or 19-pay life issued at x+1)

Mean Reserve

$$(1-h) * ({}^{m}_{t-1}V_{[x]:n} + {}^{m}_{t}P_{[x]:n}) + h * {}^{m}_{t}V_{[x]:n},$$

Mid-terminal reserve

$$(1-h) * ({}^{m}_{t-1}V_{[x]:n}) + h * {}^{m}_{t}V_{[x]:n}$$