CAS Exam 5

Seminar Style Slides
2027 Edition

prepared by
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These are slides that would be presented at a seminar.

Covered is entire syllabus of CAS Exam 5.
Basic Ratemaking is followed by Basic Reserving.

Use the bookmarks in the Navigation Panel in order to help you find what you want.

This provides another way to study the material. Some of you will find it helpful to go through a few sections at a time, either alone or with a someone else, pausing to do each of the problems included. Estimated time to go through all of the slides is about 55 hours.

Some of the problems were written by me and some are past exam questions so labeled.

All the material, problems, and solutions are in my study guide, sold separately.
These slides are a useful supplement to my study guide, but are self-contained.
There are references to page and problem numbers in the latest edition of my study guide, which you can ignore if you do not have my study guide.

The slides are in the same order as the sections of my study guides.
At the end of each of Ratemaking and Reserving, there are some additional questions for study.

Read the CAS pdf on
Bloom's Taxonomy of Question Writing



There is no firm dividing line between levels.
The CAS, particularly on the Fellowship Exams, has been testing at the higher levels.

Since 2007 the total number of “points” on the exam has decreased from 100.

For example, Fall 2013 had 58.5 points.

Thus the point value of older exam questions is not directly comparable to your exam.

For example, a 3 point question in 2007
was 3% of the 4 hour exam,
while a 3 point question in Fall 2013
was about 5% of the 4 hour exam.

Ratemaking

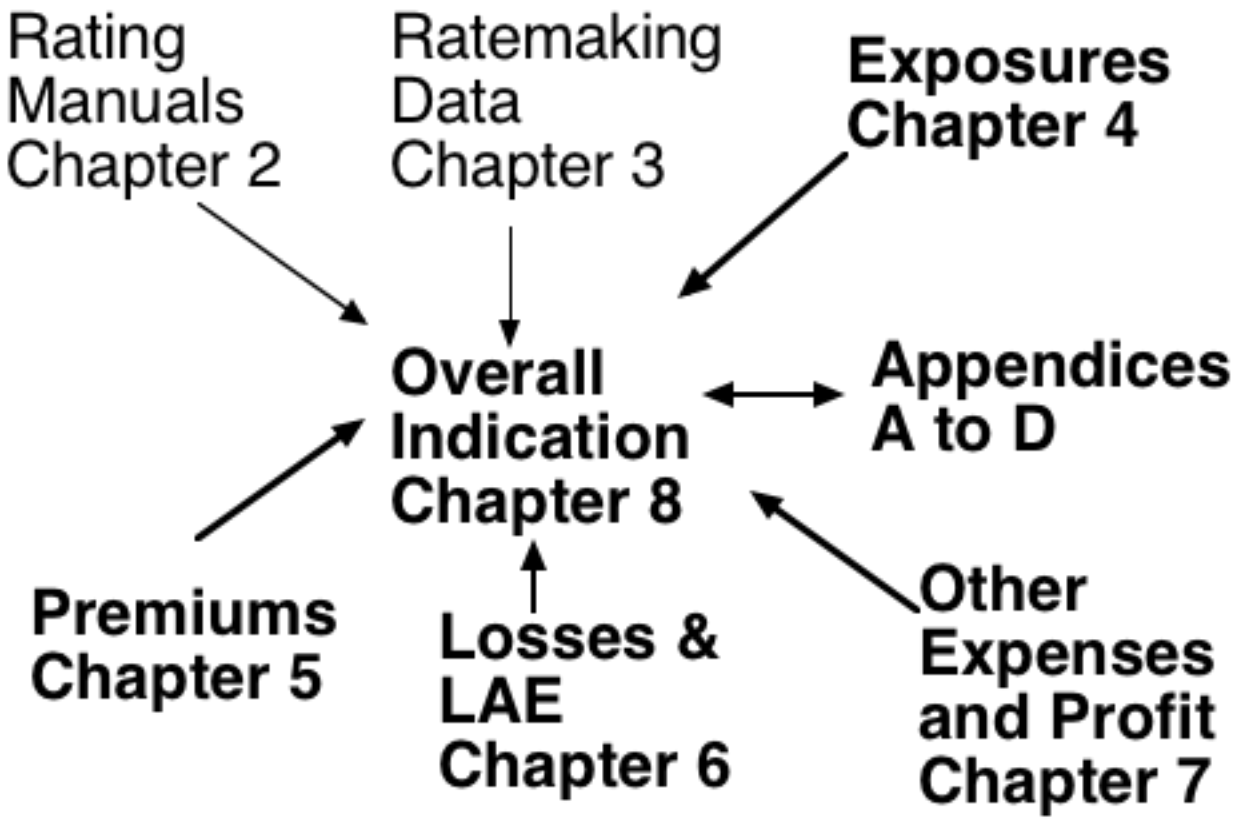
Section #	Section Name
1	Introduction
2	*Rating Manuals*
3	Ratemaking Data
4	Exposures
5	**Premium**
6	**Losses and LAE**
7	Other Expenses and Profit
8	**Overall Indication**
9	Traditional Risk Classification
10	Multivariate Risk Classification
11	Special Classification
12	Credibility
13	Other Considerations
14	Implementation
15	Commercial Lines Rating Mechanisms
16	Claims-Made Ratemaking
17	CAS Principles of Ratemaking
18	Trending Procedures in Property/Casualty Insurance Ratemaking
19	ASOP 12: Risk Classification
20	*Lifetime Value Analysis*

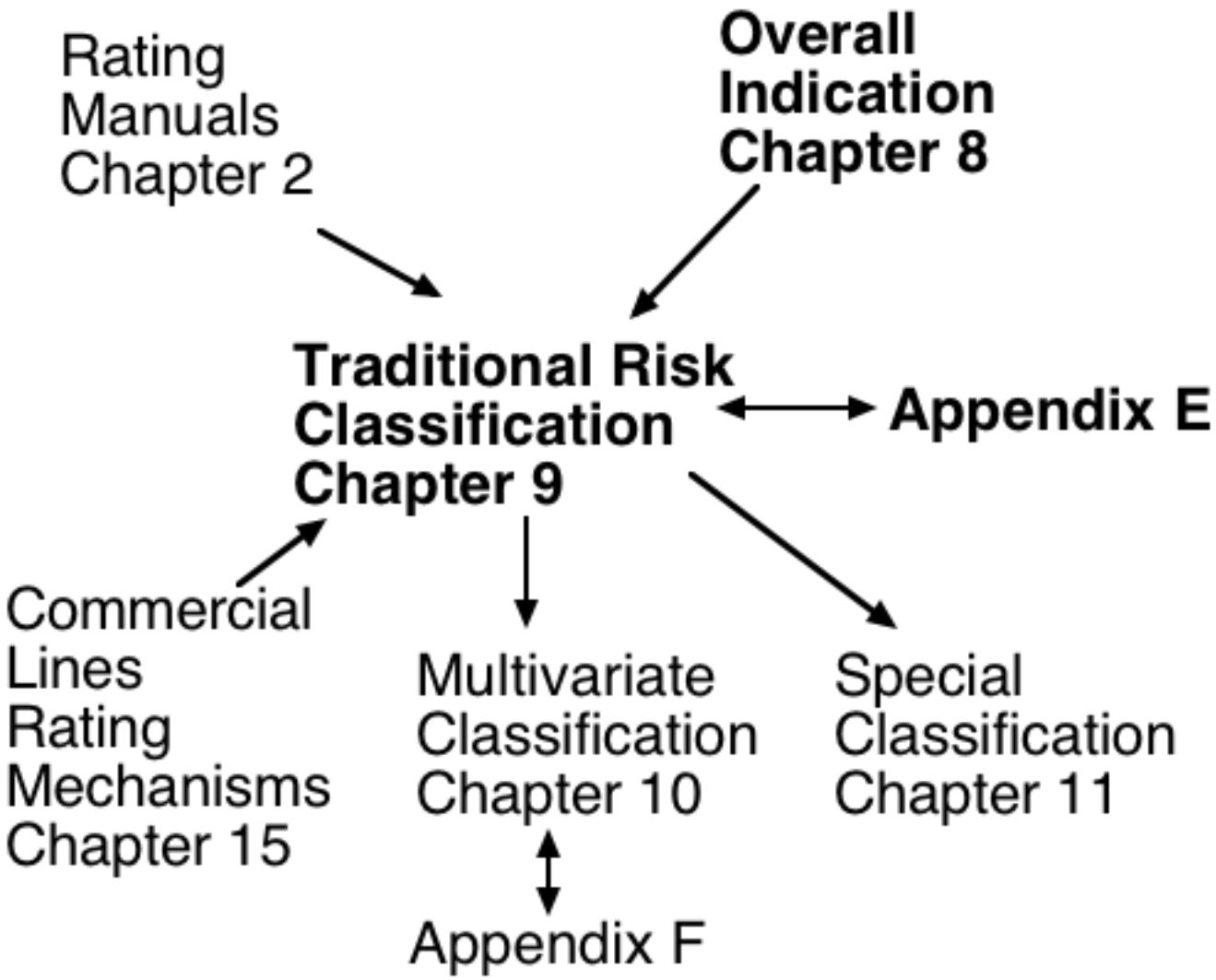
“Introduction”

Chapter 1 of Basic Ratemaking

Howard Mahler

Exam 5


Rating Manuals Chapter 2
Ratemaking Data Chapter 3
Exposures Chapter 4
Overall Indication Chapter 8
Appendices A to D
Premiums Chapter 5
Losses & LAE Chapter 6
Other Expenses and Profit Chapter 7


Rating Manuals Chapter 2
Overall Indication Chapter 8
Traditional Risk Classification Chapter 9
Appendix E
Commercial Lines Rating Mechanisms Chapter 15
Multivariate Classification Chapter 10
Appendix F
Special Classification Chapter 11

1.9 (1 point)

Given the following information:

	Calendar Year 2015
Written premium	$550 million
Earned premium	$580 million
Commissions	$44 million
Taxes, licenses and fees	$12 million
General expenses	$31 million
Other Acquisition Expenses	$18 million
LAE ratio (to loss)	12%
Combined ratio	106%

Calculate the 2015 operating expense ratio.

1.9. Take the ratio of General Expense to Earned premium: 31 / 580 = 5.34%.
Take the ratio of Commissions, Other Acquisition plus Taxes, licenses and fees to Written premiums: (44 + 12 + 18) / 550 = 13.45%.
Underwriting Expense Ratio:
5.34% + 13.45% = 18.79%.

Combined Ratio =
Loss & LAE Ratio + UW Expense Ratio.
⇒ 106% = (1.12) (Loss Ratio) + 18.79%.
⇒ Loss Ratio = 77.87%.
⇒ Ratio of LAE to Earned Premium:
(12%)(77.87%) = 9.34%.

Operating expense ratio =
LAE / Earned Premium + UW Expense Ratio
= 9.34% + 18.79% = **28.13%**.

Comment: Similar to 5, 5/11, Q.8.

“Rating Manuals”

Chapter 2 of Basic Ratemaking

Howard Mahler

Exam 5

While **no longer on the syllabus**,
Section 2 of Basic Ratemaking contains some useful background material.

I suggest that you look at one example of a rating algorithm.

Rating Manuals are used by insurers to determine the premium that will be charged a particular insured for a particular policy.

The information in a rating manual can be divided into three pieces:
Rules
Rate Pages
the **Rating Algorithm**.

In addition, the insurer will have
Underwriting Guidelines which help determine how the rating manual is used.

P.31. Rating Algorithm for Homeowners Example:

R1 = Amount of Insurance Relativity
R2 = Territory Relativity
R3 = Protection Class / Construction Type Rel.
R4 = UnderWriting Tier Relativity
C1 = Deductible Credit Factor
C2 = 1 - (New Home Discount)
- (Claims-Free Discount).
C3 = 1 - Multi-Policy Discount

Premium = (Base Rate) R1 R2 R3 R4 C1 C2 C3
+ Increased Jewelry Coverage Rate
+ Increased Liability / Medical Coverage Rate
+ Policy Fee.

“Ratemaking Data”

Chapter 3 of Basic Ratemaking

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Data is used by actuaries for many purposes including ratemaking.

For indications of the overall rate level, summarized data on:
exposures
premiums
Losses
ALAE

Data on ULAE and underwriting expenses is usually from the insurer's accounting system.

An aggregate amount may be allocated to line of insurance and/or state.

For classification and territory ratemaking, more detailed data on exposures, premiums, losses, and ALAE is used,
broken down by class and territory.

For individual risk rating,
data from a particular insured is used.

Actuaries also use detailed information
for special studies.

Ratemaking data is usually aggregated into years, as discussed below.

An insurer's data is often contained in a policy data base with exposures and premiums, and a separate claims data base with losses and alae.

Actuaries and underwriters rely on information besides the exposure, premium, loss, and expense data from their own insurer.

Data Quality:

Any analysis performed by an actuary is no better than the quality of the data that goes into that analysis.

For example, assume that under the Workers Compensation Statistical Plan one insurer mistakenly reports $500 million of payroll in a class for an employer rather than $5 million.

Assume that this results in about twice as much reported exposure in total for that class as was actually the case.

Then the reported pure premium will be half of the actual pure premium.

Unless this mistake is caught and corrected, the class relativity that results from any actuarial analysis will be erroneous!

Years of Data:

Premiums and losses can be organized in different ways.

Calendar Year: All premiums and losses related to a given calendar year.

Calendar year data might be used for ratemaking on lines on insurance where claims are reported and settled quickly, such as Automobile Collision.

Fiscal Year: Similar to a Calendar Year; however a fiscal year starts on a date other than January 1.

For example, a fiscal year might start on July 1 and end on the subsequent June 30.

Accident Year: All the losses with accident dates during a given year.

For example, an accident occurs on
March 15, 2003.
All payments related to claims resulting from this accident, are part of Accident Year 2003, regardless of when those payments are made.

Calendar/Accident Year 2003 would consist of premiums for Calendar Year 2003 and losses for Accident Year 2003.

Policy Year: All premiums and losses related to policies with effective dates during a given year.

For example, an accident occurs on
March 15, 2003.
If the policy providing coverage was written effective November 1, 2002, then all payments related to claims resulting from this accident, are part of Policy Year 2002, regardless of when those payments are made.

Policy Year data has the best match of losses to premiums, with Accident Year next, and Calendar Year worst.

Calendar Year data is available quickest, with Accident Year next, and Policy Year slowest.

Report Date: the date the insurer receives notice of the claim.

Report Year: All the losses on claims for which the insurer first receives notice during a given year.

An accident occurs on March 15, 2003.
If on June 5, 2004 the insurer first receives notice of a claim resulting from this accident, then all payments related to this claim, are part of Report Year 2004, regardless of when those payments are made.

Report Year data can be used for ratemaking for lines of insurance with a long reporting lag for claims, such as Medical Malpractice Insurance.

Such lines of insurance are often written on a claims-made rather than occurrence basis.

Page 54 Policy Database:

Detailed information on exposures and premiums.

Each data element is reported in its own “field”.
A group of fields is called a “record”.

A very simplified example of a record:
Field 1: Policy Number.
Filed 2: Policy Effective Date.
Field 3: State.
Field 4: Premium.

Typical fields for each record on the policy database:

- Policy identifier
- Risk identifier(s)
- Relevant dates
- Premium
- Exposure
- Characteristics: rating variables, underwriting variables, etc.

For use in ratemaking, records would usually be combined to create the form of the data to be used by the actuary.

For example, if a policy were canceled midterm one would need to combine records to get the net premium and exposure for that policy.

Page 55 Claims Database:

Detailed information on the losses and alae.

Typical fields for each record:

- Policy identifier
- The risk identifier(s)
- Claim identifier.
- Claimant identifier.
- Relevant loss dates: the date of loss, the report date, and the transaction date.
- Claim status: open, closed, or reopened.
- Reopen date.
- Claim count.
- Paid loss.
- Event identifier: for example a catastrophe.
- Case reserve.
- Allocated loss adjustment expense.
- Salvage/subrogation.
- Characteristics.

Accounting Information:

Underwriting expenses and unallocated loss adjustment expenses (ULAE) are not collected in either the policy or claims databases; they are collected in the insurer's accounting system.

Data from Outside Sources:

Actuaries working at an insurer use many sources of information other than data from inside the insurer, called as “external data”.

Statistical agents such as ISO and NCCI collect information from many insurers within a given state. In some cases, one can obtain this data totaled across all the reporting insurers.

The “Fast Track Monitoring System” tracks quarterly industry data for personal lines.

Other sources of aggregated data or reports:

A.M. Best

Highway Loss Data Institute (HLDI)

Insurance Research Council (IRC),

Institute for Business and Home Safety (IBHS)

National Insurance Crime Bureau (NICB)

Workers Compensation Research Institute (WCRI)

Insurers can often obtain competitor's rate filings and rate manuals from insurance departments.

Sometimes Consumer Price Indices (CPIs) are used to help estimate trends.

The U.S. Census has lots of potentially valuable information, for example: population density, weather, thefts, and annual miles driven.

Credit scores of insureds, purchased from a firm that specializing in this, can be used for classification and/or underwriting.

Additional information that may be used:

- Personal automobile insurance:
  vehicle characteristics,
  department of motor vehicle records
- Homeowners insurance: distance to fire station
- Earthquake insurance: type of soil
- Workers' compensation: OSHA inspection data

3.1 (2 points) Briefly define each of the following:
Calendar Year
Accident Year
Policy Year
Report Year

3.1. Calendar Year: All premiums and losses related to a given calendar year.

Accident Year: All the losses with accident dates during a given year. Premiums are those for the corresponding Calendar year.

Policy Year: All premiums and losses related to policies with effective dates during a given year.

Report Year: All the losses on claims for which the insurer first receives notice during a given year.

Page 60 MASS. WORKERS COMP.
Unit Statistical Plan Data
(Including Large Deductible Policies)
Composite Policy Year 1999/2000
(Policies with effective dates 7/1/99 to 6/30/00)
at First Report
(18 months after policy effective date, there are 5 reports)

Class Code:
5, Farm: Nursery Employees & Drivers
Industry Group: Goods & Services
Hazard Group 2

Payroll	$12,761,866
Manual Premium	$456,751
Standard Premium	$471,494
Total Losses	$202,093

Loss Ratio to Manual Premium	44.2%
Loss Ratio to Standard Premium	42.9%
Pure Premium (per $100 payroll)	$1.58

Class Code: 5, First Report

Indemnity Losses 133,030
Medical Losses 69,063
Claim Count 60

Fatal: Claim Count 0

Permanent Total: Claim Count 0

Major Partial Disability:
Indemnity 36,690
Medical 3,335
Claim Count 1

Minor Partial Disability:
Indemnity 16,717
Medical 4,986
Claim Count 1

Temporary Total:
Indemnity 79,623
Medical 48,629
Claim Count 11

Medical Only: Losses 12113
Claim Count 47

MASSACHUSETTS WORKERS COMP.
Annual Financial Call Data
Accident Year Data
Indemnity Plus Medical Losses ($ million)
Paid Plus Case Reserves

AY	Report				
	1	2	3	4	5
1993	319	404	434	446	447
1994	263	349	378	394	
1995	240	344	377		
1996	252	347			
1997	231				

1st report for AY93 is as of 12/31/93.
2nd report for AY93 is as of 12/31/94.
Older years would have perhaps 20 reports.

Can separate Indemnity and Medical.
Can separate Paid or can have Total Incurred (including Bulk plus IBNR.)

ALAE is reported (separately) for years 1994 and subsequent.

“Exposures”

Chapter 4 of Basic Ratemaking

Howard Mahler

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Some Examples of Exposure Bases:

Automobile: car-years or car-months.

Workers Compensation: $100 of payroll.

Homeowners: House Years.

General Liability:
Sales (mercantile or manufacturing)
or payroll (contracting).

Desirable Properties of an Exposure Base:

1. Proportional to Expected Loss

2. Practical

3. Historical Precedence

4.49b (5, 5/05, Q.36b) (1 point)
"Miles driven" is a potential exposure base for Personal Auto Liability Insurance.
Give one reason for and one reason against its use as an exposure base.

5, 5/05, Q.36b

Possible reasons for using miles driven:

The more miles driven, the larger the probability of an accident and therefore claims costs to the insurer. The exposure to loss is approximately proportional to the miles driven.

Miles driven is responsive to changes in the exposure to loss, while car years is not.

Possible reasons for not using miles driven:

Miles driven could be difficult and costly to verify.

Miles driven is subject to manipulation by either the insured or agent.

Car years are currently used, and one should avoid changing exposure bases due to problems caused by transitioning.

Comment: If the exposure was changed from car years to miles driven, the class/territory relativities would change. For example, part of the reason senior citizens are charged less than average per car-year, is because on average they drive less. It is likely that the expected losses per mile driven, as opposed to per car-year, are higher than average for senior citizens.

Page 73 Written Exposures:

Written Exposures are the exposures insured by a policy.

An annual automobile policy that insures one car, has one car year.

A six-month automobile policy that insures one car, has a half of a car year.

A six-month automobile policy that insures three cars, has one and a half car years.

All of the exposures written on a policy go into the calendar year, calendar quarter, or policy year in which the policy effective date falls.

Earned Exposures:

Coverage is provided under an insurance policy for a period of time.
For an annual policy written December 1,
at the end of the year only 1/12 of the coverage was provided.
If this policy covers one car, then at the end of the year 1/12 of a car year has been earned.

Earned Exposures are the portion of exposures for which coverage has been provided by a certain date.

Exercise: An annual policy covering one home is written with effective date March 1, 2008.
What does it contribute in written and earned exposures to different Calendar Years?

1 written house year to Calendar Year 2008, and no written house years to Calendar Year 2009.
5/6 earned house year to Calendar Year 2008, and 1/6 earned house years to Calendar Year 2009.

While for Calendar Years of data written and earned differ, for Policy Years of data they are the same at ultimate.

Exercise: An annual policy covering one home is written with effective date March 1, 2008.
What are the Policy Year written and earned exposures as of December 31, 2008?
What are the Policy Year written and earned exposures as of December 31, 2009?

As of December 31, 2008, 1 written house year to Policy Year 2008.

As of December 31, 2008, 5/6 earned house year to Policy Year 2008.

As of December 31, 2009, 1 written house year to Policy Year 2008.

As of December 31, 2009, 1 earned house year to Policy Year 2008.

One can add up the contributions of many policies.

For example, one might aggregate the exposures for all of an insurer's policies for a certain line of insurance in certain given state.

One might aggregate the exposures separately by class and territory.

Unearned Exposures:

Unearned Exposures are the portion of exposures for which coverage has not been provided by a certain date.

Exercise: An annual policy covering one home is written with effective date March 1, 2008.
What are the unearned exposures as of December 31, 2008?
What are the unearned exposures as of December 31, 2009?

1/6 unearned house year as of 12/31/2008.
No unearned house years as of 12/31/2009.

For an individual policy at any given point in time:
Written Exposures =
Earned Exposures + Unearned Exposures.

Inforce Exposures:

Inforce Exposures are the number of exposures for which coverage is being provided at a given point in time.

The 19th Century Insurance Company provides homeowners insurance.

On July 23, 2009, if all the homes they insure in a certain state were destroyed, they would have to pay to replace 10,000 homes.

Then, as of July 23, 2009, they have 10,000 inforce exposures in this state.

This would be 10,000 inforce homes; inforce exposures have no time duration attached to them.

Inforce exposures represent a snapshot of the insurer's book of business at a given point in time.

Sometimes in-force exposures will be given as for example car-years rather than cars.
See for example 5, 11/16, Q.1b.

4.13 (3 points) The following 6 policies are written:

Policy Effective Date	Policy Term	Number of Automobiles Covered
September 1, 2004	6 months	1
October 1, 2004	12 months	2
January 1, 2005	12 months	3
June 1, 2005	6 months	1
August 1, 2005	6 months	2
December 1, 2005	12 months	1

As of December 31, 2005, determine the following:
Calendar Year 2005 Written Exposures,
Calendar Year 2005 Earned Exposures,
Unearned Exposures,
and the Inforce Exposures.

4.13. The four policies written during 2005, contribute all of their exposures to the written exposures for Calendar Year 2005.

The written exposures for Calendar Year 2005 are: 3 + 1/2 + 2/2 + 1 = **5.5 cars years**.

For the first policy written Sept. 1, 2004, a 6 month policy which expires February 28, 2005, 1/3 of its exposures are during Calendar Year 2005.
For the second policy written Oct. 1, 2004, an annual policy that expires on Sept. 30, 2005, 3/4 of its exposures are during Cal. Year 2005.
For the third policy written Jan. 1, 2005, an annual policy that expires on Dec. 31, 2005, all of its exposures are during Cal. Year 2005.
For the fourth policy written June 1, 2005, a 6 month policy which expires Nov. 30, 2005, all of its exposures are during Cal. Year 2005.
For the fifth policy written Aug. 1, 2005, a 6 month policy which expires Jan. 31, 2006, 5/6 of its exposures are during Cal. Year 2005.
For the sixth policy written Dec. 1, 2005, an annual policy that expires on Nov. 30, 2006, 1/12 of its exposures are during Cal. Year 2005.

Calendar Year 2005 Earned Exposures are:
(1/3)(1/2) + (3/4)(2) + (1)(3) + (1)(1/2) + (5/6)(2/2)
+ (1/12)(1) = **6.083 car years**.

On December 31, 2005, only the last two policies have Unearned Exposures:
(1 - 5/6)(2/2) + (1 - 1/12)(1) = **1.083 car years**.

Alternately, for the four policies written in 2005, their Calendar Year 2005 earned exposures are:
(1)(3) + (1)(1/2) + (5/6)(2/2) + (1/12)(1) =
4.416 car years.
The written exposures for Calendar Year 2005 are:
3 + 1/2 + 2/2 + 1 = 5.5 car years.
Therefore, the unearned exposures at the end of 2005 are: 5.5 - 4.416 = **1.083 car years**.

On December 31, 2005, the 3rd, 5th, and 6th policies are providing coverage for a total of six automobiles; the Inforce Exposures are **6 cars**.

Comment: Similar to 5, 5/05, Q.14.
Note that inforce exposures do not have any time duration associated with them.

Page 75 Cancelations:

An annual policy covering one car is written with effective date September 1, 2009.

If the policy is canceled on December 1, 2009, then only 3 months of coverage was provided, and there is 1/4 car year contributed
to both written and earned exposures
for Calendar Year 2009.

If instead the policy is canceled on March 1, 2010, then only 6 months of coverage was provided.

At the end of 2009 we would not know that the policy would be canceled.

There would be 1 car year contributed to Calendar Year 2009 written exposures and
-1/2 car year contributed to Calendar Year 2010 written exposures.

The total written exposures add up to the correct 1/2 car year.

1/3 of a car year is contributed to the earned exposures for Calendar Year 2009, and 1/6 of a car year is contributed to the earned exposures for Calendar Year 2010, for a total of 1/2 car year.

Endorsements:

An annual policy covering one car is written with effective date September 1, 2009.

If the policy is endorsed on March 1, 2010 to add another car, then the second car will be provided with only 6 months of coverage.

As of the end of 2009 we would not know that this policy would be endorsed.

This policy contributes 1 car year to Calendar Year 2009 written exposures and 1/2 car year to Calendar Year 2010 written exposures.

From the first car, there are 4/12 car years earned in CY09 and 8/12 car years earned in CY10.

From the second car, there are 6/12 car years earned in CY10.

This policy contributes 4/12 car years to CY09 earned exposures and 14/12 car years to CY10 earned exposures, for a total of 1.5 car years.

Diagrams:

One can draw diagrams to represent exposures and premium.

Such diagrams are the basis of the parallelogram method of putting premiums on-level.

Some people will find them helpful for dealing with exposures.

Rate at Which Exposures are Earned:

Unless stated otherwise,
assume that exposures are earned evenly throughout the policy term.

However, there are situations in which exposures are not earned evenly throughout the policy term.

Exposure Trend:

Certain exposure bases are inflation sensitive.

For example, sales or payroll are expected to increase with inflation.

Therefore, prior to being used to get an overall rate indication for General Liability Insurance or Workers Compensation, such exposures bases are adjusted from the past inflation level to the inflation level expected in the future.

An exposure trend factor will be applied to the historical premiums.

Assume that Workers Compensation
Policy Year 2010 payrolls were $100 million.

We are trying to be make new rates to be effective during Policy Year 2013.

We think that exposures will increase due to inflation by 2% per year.

Then we project the reported payrolls for three years of inflation:

($100 million) (1.02^3) = $106.1 million.

Audits:

Certain exposure bases such as sales or payroll are usually subject to audit.

When written a certain Commercial General Liability policy assumed $80 million in sales for purposes of determining the preliminary premium.

Sometime after expiration of the policy the actual sales during the policy period are determined and used to calculate the final premium.

The actual sales will turn out to be different than $80 million.

Such audits can have a number of effects on exposures.

A policy written in one year can contribute to the Calendar Year written exposures for the next year.

A policy is written March 1, 2010, with an initial estimate of sales of $80 million.

At final audit on July 1, 2011, the sales are determined to be $82 million.

Then $2 million of written exposures are contributed to Calendar Year 2011.

If instead the audited sales were $77 million, then this policy would contribute -$3 million of written exposures to Calendar Year 2011.

See for example 5, 11/14, Q.2.

Policy Year written exposures take a while to be final; they develop.

For example, the audits of the policies written late in 2010 will not have been completed until sometime in early 2012.

Thus Policy Year 2010 written exposures will not be final until then.

Reserving

Section #	Section Name
1	Introduction
2	The Claims Process
3	Understanding the Types of Data Used
4	*Meeting with Management*
5	The Development Triangle
6	The Development Triangle as a Diagnostic Tool
7	**Development Technique**
8	Expected Claims Technique
9	**Bornhuetter-Ferguson Technique**
10	Cape Cod Technique
11	**Frequency-Severity Techniques**
12	Case Outstanding Development Technique
13	**Berquist-Sherman Techniques**
14	Recoveries: Salvage and Subrogation and Reinsurance
15	Evaluation of Techniques
16	Estimating Unpaid Allocated Claim Adjustment Expenses
17	Estimating Unpaid Unallocated Claim Adjustment Expenses
18	*ASOP #43, Unpaid Claim Estimates*

“Introduction”

Section 1 of Basic Reserving

Howard Mahler

Exam 5

Estimating Unpaid Claims Using Basic Techniques is divided into four parts:

- Part 1 – Introduction: Chapters 1-2.
- Part 2 – Information Gathering: Chapters 3-6.
- Part 3 – Basic Techniques for Estimating Unpaid Claims: Chapters 7-15.
- Part 4 – Estimating Unpaid Claim Adjustment Expenses: Chapters 16-17.

Page 10 Importance of Accurately Estimating Unpaid Claims:

- **Insurers sell a promise to pay for a future covered event.**
- **Insurers may not know the ultimate cost of a covered event for many years.**
- **Insurers must regularly report their financial results.**
- **Claim reserves are set up to cover the future costs of covered events that have already occurred but for which the insurer has yet to pay.**
- **Actuaries estimate the ultimate claims and thus the needed claim reserves.**

From the Viewpoint of Internal Management:

Accurate claims reserves are important for:

- **Ratemaking/Pricing**.
- Deciding to Expand or Contract its Book of Business.
- Deciding on Reinsurance Needs.
- Deciding which lines of business get a larger proportion of Allocated Capital.

From the Viewpoint of Investors:

Accurate claims reserves are important for:

- Decisions on whether to buy or sell stock in the insurer.

From the Viewpoint of Regulators:

Accurate claims reserves are important for:

- **Accurately assessing the Financial Condition of the insurer**.
- Deciding whether or not to approve a requested rate change.

Components of the Estimate of Unpaid Claims:

The unpaid claims estimate includes five components:

- **case outstanding on known claims.**
- **provision for future development on known claims.**
- **estimate for reopened claims.**
- **provision for claims incurred but not reported.**
- **provision for claims in transit (i.e., claims reported but not recorded).**

Case outstanding on known claims consists of individual case reserves set by claims adjusters.

The remaining four components make up **IBNR, Incurred But Not Reported**.
IBNR = IBNER + Pure IBNR.

IBNER = Incurred But Not Enough Reported = Development on Known Claims.
IBNER includes: the provision for future development on known claims plus
the estimate for reopened claims.

Pure IBNR = IBNYR
= Incurred But Not Yet Reported.
Pure IBNR includes: the provision for claims incurred but not reported plus
the provision for claims in transit (i.e., claims reported but not recorded).

1.9. (5, 11/19, Q.16) (1.5 points)

a. (0.75 point) List three components of an unpaid claims estimate.

b. (0.75 point) Briefly describe how an inadequate unpaid claims estimate can impact the decision-making of each of the following parties:

i. Internal management

ii. Investors

iii. Regulators

5, 11/19, Q.16 (a) The unpaid claims estimate includes five components:

- case outstanding on known claims
- provision for future development on known claims
- estimate for reopened claims
- provision for claims incurred but not reported
- provision for claims in transit (i.e., claims reported but not recorded).

(b) i. Possible answers for Internal Management:

- Might decide to lower rates when this is not warranted.
- Might make an incorrect decision to expand business that is unprofitable.
- Might make an incorrect decision to loosen underwriting guidelines.
- Might make an incorrect decision on reinsurance needs.
- Might make an incorrect decision on which lines of business get a larger proportion of allocated capital.

ii. Possible answers for Investors:

- Likely to believe that the insurer is more profitable than it actually is.
- Company will be overvalued and attract investors.

iii. Possible answers for Regulators:

- May not spot a potential insolvency in time to intervene.
- Might not approve a needed rate increase.

Page 16 Terminology Used by Friedland:

Insurer: Any risk bearer for Property & Casualty exposures, such as an insurance company, self-insured, etc.

Unpaid claim estimate: estimate of the obligation for future payment resulting from claims due to past events.

Claims: Dollars of Loss.

Claim Counts: Number of claims.

Reported Claims:
Paid Claims plus Case Reserves.

Ultimate Claims: Total dollars after all claims are settled and closed without any chance of reopened claims.

Claim Related Expenses:
Claim Adjustment Expenses.

Experience Period: The past years used in estimating unpaid claims.

Emergence: The reporting or development of claims and claim counts over time.

Claim Related Expenses:

Claim adjustment expenses are the costs of administering, determining coverage for, settling, or defending claims even if it is ultimately determined that the claim is invalid.

Loss adjustment expenses can be divided into two parts: allocated loss adjustment expenses (ALAE) and unallocated loss adjustment expenses (ULAE).

ALAE can be assigned to a particular claim, such as legal and expert witness expenses.

ULAE is not easily allocated to a specific claim, such as the payroll, rent, and computer expenses for the claims department of an insurer.

In the United States, for statutory reporting purposes, loss adjustment expenses are divided into two parts: defense and cost containment (DCC) and adjusting and other (A&O).

DCC expenses include all defense litigation and medical cost containment expenses regardless of whether internal or external to the insurer.

A&O expenses include all claims adjusting expenses, whether internal or external to the insurer.

Generally, your exam questions deal with ALAE and ULAE, rather than DCC and A&O.

Regulation and Loss Reserves:

Many jurisdictions have legal requirements for accurate estimation of unpaid claim, and put the responsibility on the Appointed Actuary.

“The Claims Process”

Section 2 of Basic Reserving

Howard Mahler

Exam 5

A claims examiner, claims adjuster, or claims handler, can be an employee of the insurer or an employee of an organization external to the insurer such as a Third Party Administrator (TPA).

Assuming a claim is covered the claims adjuster sets up an initial case reserve. The claims adjuster generally reviews the following:
policy limits,
deductibles,
reinsurance or excess coverage,
reporting requirements,
mitigation of loss requirements,
extent of injury and damages,
extent of fault,
potential other parties at fault,
and potential other sources of recovery.

The Life of a Claim:

Claim activity typically extends over a period of time, often several years.

The estimated value of a claim changes over the life of the claim;
the value of a claim is not ultimately established until the claim is finally closed.

An Example of Claim Transactions:

Date	Transaction	Reported Value of Claim to Date	Cumulative Paid to Date
Dec.1, 2022	Accident occurs		
Jan. 15, 2023	Claim is reported and opened with initial case reserve of $20,000	$20,000	0
Oct. 20, 2023	Case reserve increased to $30,000	$30,000	0
March 7, 2024	Expense payment to Independent Adjuster of $2000	$27,000	$27,000
	Claim Closed with payment of $25,000		
July 31, 2024	Claim Reopened with case reserve of $10,000	$37,000	$27,000
Aug. 22, 2024	Case Closed with payment of $10,000	$38,000	$38,000
	Expense payment to Independent Adjuster of $1000		

The calendar year 2023 reported loss and ALAE is $30,000.
The calendar year 2024 reported loss and ALAE is:
$38,000 - $30,000 = $8000.

Four-Phase Approach to Loss Reserving:

- **Exploring the data** to identify its key characteristics and possible anomalies.
  Balancing data to other verified sources should be undertaken at this point.
- **Applying appropriate techniques for estimating unpaid claims**.
- **Evaluating** the conflicting results of the various methods used, with an attempt to reconcile or explain the different outcomes. At this point, the projected ultimate amounts are evaluated in contexts outside their original frame of analysis.
- **Monitoring** projections of claim development over subsequent calendar periods.
  Deviations of actual development from projected development of counts or amounts are one of the most useful diagnostic tools in evaluating the accuracy of unpaid claim estimates.

2.2. (1 point)
The following transactions occur on a claim:

Feb. 14, 2022	Accident occurs
May 21, 2022	Claim is reported and opened with initial case outstanding of $25,000
Nov. 6, 2022	A payment of $4,000 is made and case outstanding is reduced to $20,000
March 15, 2023	The case outstanding is increased to $30,000
Oct. 22, 2024	An additional payment of $33,000 is made and case outstanding is reduced to $0
Jan. 13, 2025	$15,000 is recovered on the claim through subrogation

Determine the reported losses for Accident Year 2022 as of:

- December 31, 2022.
- December 31, 2023.
- December 31, 2024.
- December 31, 2025.

2.2.

AY22 reported losses as of December 31, 2022: **$24,000**.

AY22 reported losses as of December 31, 2023: **$34,000**.

AY22 reported losses as of December 31, 2024: **$37,000**.

AY22 reported losses as of December 31, 2025: **$22,000**.

Comment: Similar to Table 1 in Chapter 2 in Friedland.

“Understanding the Types of Data Used”

Section 3 of Basic Reserving

Howard Mahler

Exam 5

An actuary wants to divide the data into sufficiently homogeneous groups while maintaining sufficient credibility of the data.

Calendar Year vs. Accident Year vs. Policy Year:

Policy Year data provides the best match between premiums and losses, but at the cost of taking longer to be available.

Calendar Year data provides the worst match between premiums and losses, but has the advantage of becoming available sooner.

Accident Year data has a better match between premiums and losses than Calendar Year, but not as good a match as Policy Year. Accident Year data is available sooner than Policy Year, but not as soon as Calendar Year.

Advantages of Report Year Data:

- The number of claim counts is fixed at the close of the year.
- More stable data than Accident Year data.
- More determinable development patterns than Accident Year data.

Disadvantage of Report Year Data:

- Only measures development on known claims and not pure IBNR.

Generally internal data is preferable to external data.

3.2. (1.5 points) Information about two lines of insurance:

Accident Year	Commercial Auto Property Damage Reported Claims ($000)			
	12 Months	24 Months	36 Months	48 Months
2021	20,000	29,000	33,000	36,000
2022	22,000	32,000	37,000	
2023	23,000	33,000		
2024	24,000			

Accident Year	Personal Auto Property Damage Reported Claims ($000)			
	12 Months	24 Months	36 Months	48 Months
2021	30,000	39,000	41,000	42,000
2022	35,000	45,000	48,000	
2023	40,000	52,000		
2024	45,000			

a. (1 point) Based on the data, fully discuss whether it would be appropriate to combine these two lines of business for estimating unpaid claims.

b. (0.5 point) Briefly describe two additional factors that generally should be considered when deciding whether to combine lines of business for estimating unpaid claims.

3.2. (a) Compute loss development factors to 48 months for Commercial Automobile.

Accident Year	Commercial Auto Property Damage Reported Claims ($000)			
	12 Months	24 Months	36 Months	48 Months
2021	20,000	29,000	33,000	36,000
2022	22,000	32,000	37,000	
2023	23,000	33,000		
2024	24,000			
	Age to Age Factors			
2021	1.450	1.138	1.091	
2022	1.455	1.156		
2023	1.435			
Average	1.446	1.147	1.091	
To 48 months	1.810	1.251	1.091	1.000

Compute loss development factors to 48 months for Personal Automobile.

Accident Year	Personal Auto Property Damage Reported Claims ($000)			
	12 Months	24 Months	36 Months	48 Months
2021	30,000	39,000	41,000	42,000
2022	35,000	45,000	48,000	
2023	40,000	52,000		
2024	45,000			
	Age to Age Factors			
2021	1.300	1.051	1.024	
2022	1.286	1.067		
2023	1.300			
Average	1.295	1.059	1.024	
To 48 months	1.405	1.085	1.024	1.000

The development factors differ significantly, and Personal Automobile is growing much faster than Commercial Automobile.

Thus combining the two lines would distort the estimate of unpaid claims.

Also each of the data sets has enough data to be credible.

(b) Possible responses (any two):

- Are there similar similar severities.
- Is there similar adequacy of case reserves.
- Are there similar likelihoods of a claim reopening.
- Consistency of the coverage triggered by the claims in the group (i.e., group claims that will generally be subject to the same or similar laws, policy terms, claims handling, etc.)
- Are there similar reporting patterns.
- Are there similar settlement patterns.

Comment: Similar to 6, 11/10, Q.13.

“Meeting With Management”

Section 4 of Basic Reserving

Howard Mahler

Exam 5

An actuary should understand the environment, both internal and external to the insurer.

Questions for a Claims Executive:

- **Have there been any significant changes in the guidelines for setting and reviewing unpaid case during the last five years**?
- **Has the size of the caseload of the average claims adjuster changed significantly in the past several years**?
- **Have there been any noticeable changes in the rate of settlement of claims recently**?
- **Are unpaid case set at an expected level, the most likely settlement amount, or the minimum possible amount (or some other standard)**?

Questions for an Underwriting Executive:

- **What significant changes have occurred in your company's book of business and mix of business in the past five to seven years**?
- **Have any significant changes occurred in your underwriting guidelines in recent years**?

Questions for a Data Processing or Accounting Executive:

- **Have new data processing systems been implemented in recent years?**

Questions for Actuaries Specializing in Ratemaking:

- **What data which is currently used for ratemaking purposes could also be used in testing unpaid claims?**

4.8. (6, 11/06, Q.20) (1.5 points)

a. (0.5 points) Why is it important for the actuary to engage in discussions with management in business areas, such as claims and underwriting, when performing a reserve analysis?

b. (1 point) A review of the claims data for a company reveals that the time it takes to settle a claim once it has been reported has increased over the last six months.
Identify two questions that you would ask of claims management of that company to better understand this trend.

6, 11/06, Q.20. (a) Any changes made to claims department processes could affect claim closure patterns, case reserve adequacy, etc.
It is important to talk with underwriting so that you know about any changes in the mix of business, changes in underwriting guidelines, pricing, etc. These could affect loss emergence, frequency, severity, loss ratios, etc.

(b) Possible responses (any two):

- Has the caseload per claim department adjuster changed?
- Has there been a change in priorities as far as settling large claims versus small claims?
- Have there been any shifts toward the more vigorous defense of suits?
- Has there been a change in philosophy regarding trivial or very small claims?

Comment: At pages 45 to 47 of Friedland, there are many other sample questions to ask claims management, but in part (b) I have only included items that might affect the settlement rate.

“Development Triangles”

Section 5 of Basic Reserving

Howard Mahler

Exam 5

Development triangles are the workhorses of reserving analysis. They come in many varieties.

Paid data is as of December 31, 2024:

Accident Year	Cumulative Paid Claims ($000) as of (months)			
	12	24	36	48
2021	105	235	437	625
2022	110	397	635	
2023	116	486		
2024	146			

Data periods such as accident years are measured from their start.

AY21 at 12 months is as of December 31, 2021. $105,000 has been paid for AY21 by December 31, 2021. This is usually called first report.

$235,000 has been paid for AY21 by December 31, 2022. This is usually called second report.

This triangle only goes out to 48 months.

If an exam question were to say that there is no development beyond 48 months, this means that 48 months is “ultimate”;
ultimate means that there are no more claims transactions beyond that point in time.

An actuary should analyze development until there are no more changes in the quantity of interest.

Calendar Years are represented by southwest to northeast diagonals.

E**ach row represents an Accident Year**.

Each column in the claim development triangle represents an age or maturity.

Data can also be arranged by:

- Accident Half-Years
- Accident Quarter-Years
- Policy year
- Report year

Data can be:

- Cumulative Paid Losses
- Incremental Paid Losses
- Cumulative Reported Losses
  Reported = Paid + Outstanding
- Incremental Reported Losses
- Outstanding Losses
- Reported Claim Counts
- Closed Claim Counts
- Claim Severities

5.3. (1.25 points)
Given the following claim detail (000s):

Accident Date	Paid During 2018	Case Reserve at Year End 2018	Paid During 2019	Case Reserve at Year End 2019	Paid During 2020	Case Reserve at Year End 2020
April 6, 2018	$330	$210	$280	$0	$0	$0
Aug. 14, 2018	$110	$400	$0	$400	$200	$250
Oct. 19, 2018			$90	$70	$60	$30
Jan. 25, 2019			$300	$300	$180	$100
Sept.1, 2019			$220	$400	$300	$0
Dec. 7, 2019			$0	$200	$90	$150
May 11, 2020					$130	$350
July 23, 2020					$400	$800

Construct the cumulative accident year reported loss development triangle as of December 31, 2010.

5.3. AY18: Claims 1 to 3.
AY19: Claims 4 to 6.
AY20: Claims 7 and 8.
Cumulative Reported Claims =
Cum. Paid Claims + Case Reserves at Year End.
For AY18, 330 + 110 + 210 + 400 = $1050.
330 + 110 + 280 + 90 + 400 + 70 = $1280.
330 + 110 + 280 + 90 + 200 + 60 + 250 + 30
= $1350.

Accident Year	Cumulative Reported Claims (000s)		
	12 Months	24 Months	36 Months
2018	$1,050	$1,280	$1,350
2019	$1,420	$1,340	
2020	$1,680		

Comment: Similar to 5, 5/11, Q.22a.

Page 84 Short-tail Versus Long-tail Lines of Property/Casualty Insurance:

Long-tail lines take longer for all claims to be settled and paid than short-tail lines of insurance.

Good examples of short-tail lines are:
Health Insurance
Automobile Collision Insurance.

Good examples of long-tail lines are:
General Liability
Medical Malpractice

Claim Count Data:

How claim count data is recorded can differ between insurers.

Does the insurer of an automobile accident with payments for multiple coverages or to multiple parties count it as one claim or multiple claims?

How does the insurer treat reopened claims? Are they coded as a new claim or is a previously closed claim reopened?

Does the insurer include claims closed with no payment (CNP) in the reported and closed claim count triangles?

Some insurers define reported claim counts as only those claims with a positive case reserve and/or with a claim payment.

How are claims classified that have only ALAE payments and no claim payment?