

# INTRODUCTION TO INSURANCE

November 6, 2025

# AGENDA



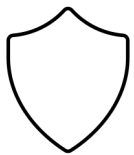
Why Insurance



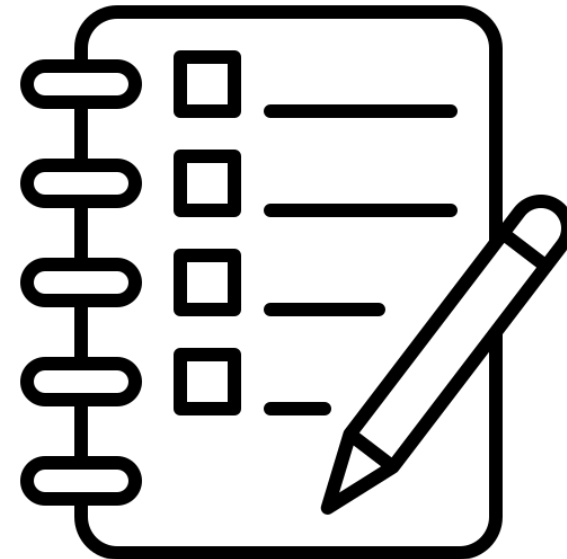
Pricing & Reserving



Adverse Selection



Common Insurance Products



01

# WHY INSURANCE?



# WHY INSURANCE?

- **Myth:** Insurance companies make huge profits
  - Payouts aren't proportional to what they collect in premiums, so policyholders must be losing money
- **Reality:** Insurance is about transferring and pooling risk
  - Policyholders exchange a small, predictable cost (premium) for protection against potentially catastrophic losses
  - Even insurance companies themselves buy insurance (reinsurance) to protect against large, unpredictable losses



# WHY INSURANCE?

- **Key Idea:** Insurance allows individuals and businesses to use their money more efficiently
- By paying a relatively small premium, policyholders don't need to keep large emergency funds for potential losses
  - Frees up money for investments, savings, and business growth
  - Enhances financial flexibility while maintaining security



# WHY INSURANCE?

- Especially in life insurance, modern products now include **investment-linked** features
- A portion of the premium is invested, allowing policyholders to earn returns over time
- These maturity benefits help hedge against inflation and build long-term wealth
- Examples
  - Universal Life Insurance
  - Variable Life or Unit-Linked Insurance Plans (ULIP)



# CASE STUDY 1: THE TITANIC

- The Titanic was insured for £1 million by Lloyd's of London and other marine insurers
  - Huge amount in comparing to total marine insured losses for the year 1912 (only ~ £6.75 million)
- **Interesting Points**
  - *Notable car insurance claim:* passenger William Carter claimed \$5000 for his Renault that sank with the ship
  - *Biggest life insurance pay-out of its time:* John B. Thayer, a prominent Philadelphian businessman, drowned in the Titanic and his wife received a \$50,000 payout
  - *Refusal to insure:* One insurer, British Dominions Marine Insurance, declined to underwrite the Titanic, citing concerns about the ship's low profile in the water

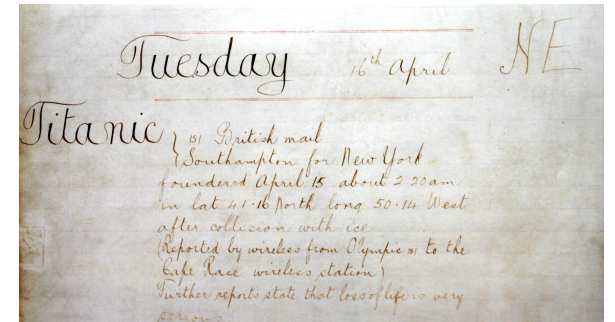


Figure 1: Famous entry of Titanic's collision in Lloyd's loss books

# CASE STUDY 2: CELEBRITIES

- In industries where physical attributes are tied directly to income/brand, special insurance covers the risk of injury or disability affecting those attributes
- **Notable Examples**
  - David Beckham: The soccer star reportedly insured his legs for \$195 million, given the essential role they play in his career
  - Taylor Swift: Insured her legs for an estimated \$40 million – this insurance was reportedly taken out before a major concert tour
  - Miley Cyrus: Insured her vocal cords for an undisclosed amount to protect her primary asset as a singer
- **Why this matters:** these policies combine liability with protection of an intangible asset (brand, performance ability)





# CASE STUDY 3: 2025 LA WILDFIRES

- In January 2025, the Los Angeles wildfires damaged over 55,000 acres in total (combined total from Palisades Fire, Eaton Fire, etc.)
- Estimated insured losses over \$24 billion
  - Overall economic losses could reach more than \$250 billion when accounting for longer-term latent damages – protection gap
- This event highlights how P&C insurance must account for extreme events and how reinsurers play a critical role in absorbing financial shock
  - Illustrates the actuarial challenge of estimating tail risk



02

# PRICING & RESERVING



# GENERAL TERMINOLOGY

- **Insured:** The person or entity that receives insurance coverage
  - Only protected from risks and entitled to benefits as outlined in the policy
- **Exposure:** Basic unit of risk that the insurer covers
  - Measurable item or time period over which the company assumes potential loss
  - For instance, homeowners – house per year, auto – car year, health – per member per month
- **Premium:** The regular payment (monthly, quarterly, or annually) made by the insured to the insurer to maintain active coverage

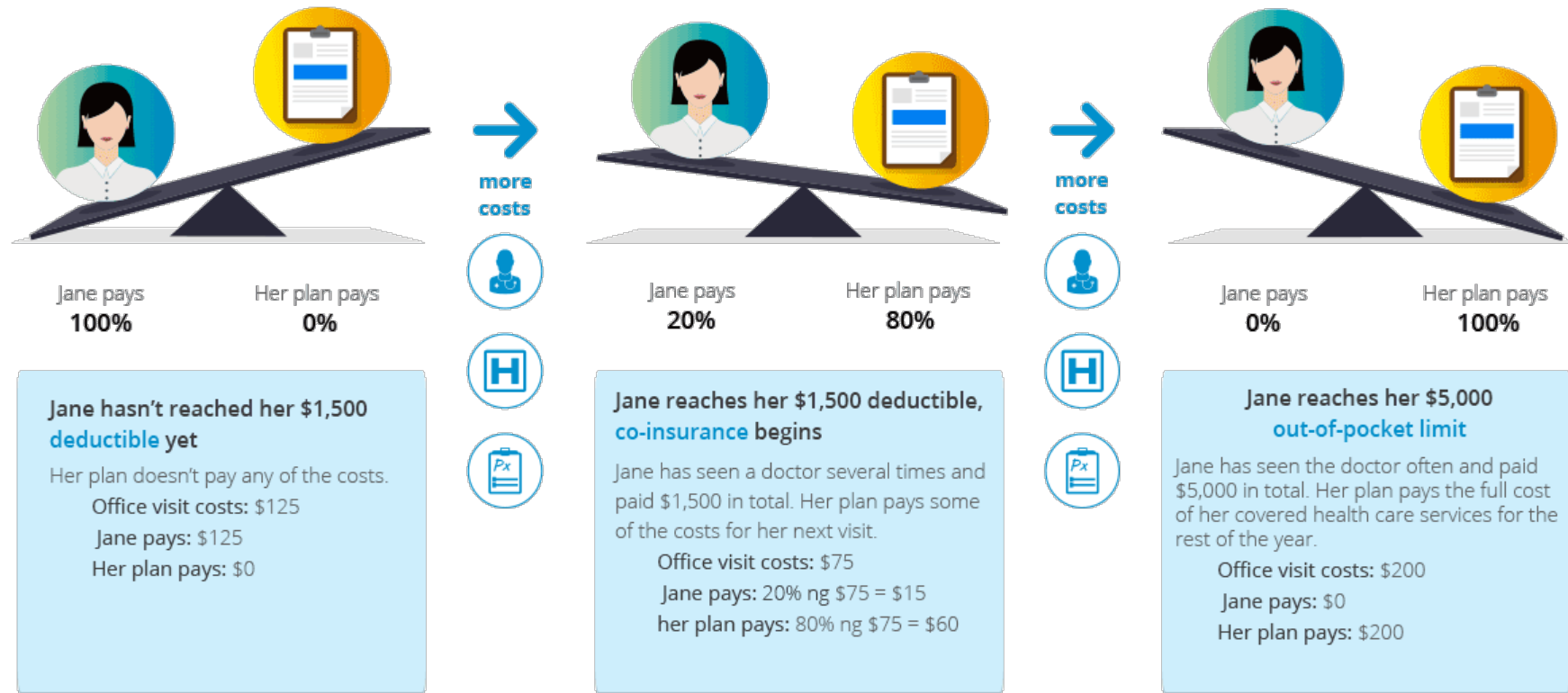


# GENERAL TERMINOLOGY

- **Underwriting:** The process by which insurers evaluate the risk associated with a prospective policyholder and determine the terms, coverage limits, and premiums based on that risk assessment
- **Lapse Rate:** The rate at which insurance policies are terminated or expire due to non-payment of premiums or other reasons
- **Grace Period:** The additional time after a premium due date during which the policyholder can pay without the policy lapsing
  - Coverage remains active during grace period



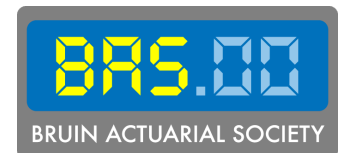
# COST SHARING TERMINOLOGIES



# EXPOSURES AND PREMIUMS

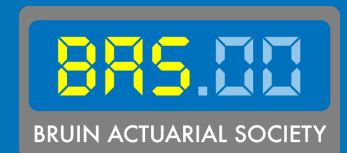
Exposures and premium can be measured in the following ways:

- **Written:** total exposures arising from policies written during a specific period
- **Earned:** portion of written exposures for which coverage has been provided as of a certain point in time
- **Unearned:** portion of written exposures for which coverage has not been provided as of a certain point in time
- **In-force:** total number of exposures of active policies at a given point in time

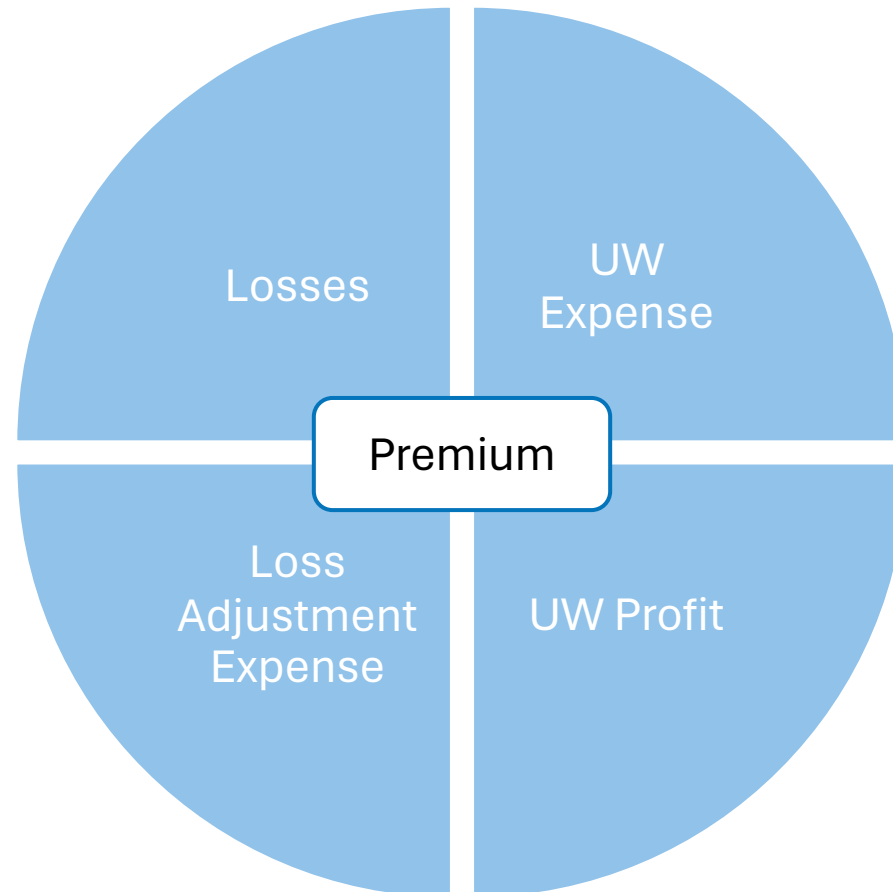


# IBNR CLAIMS

- IBNR = Incurred But Not Reported
- Until the claimant reports the claim to the insurer (i.e. the report date), the insurer is not aware of the claim
- Claims not known by the insurer are known as unreported claims or IBNR claims
- **Example:** A person might be injured in a car accident but delays reporting the claim due to hospitalization
  - Although the insurer has not yet received the claim, it should anticipate such events and have reserves set aside to handle these “hidden” liabilities



# FUNDAMENTAL INSURANCE EQUATION





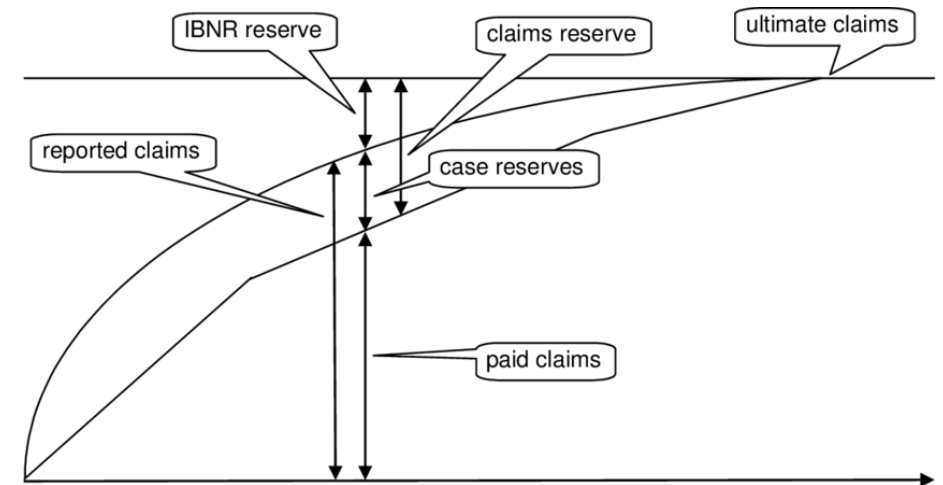
# FUNDAMENTAL INSURANCE EQUATION

- Pricing and reserving stem from the equation
- Ratemaking (or pricing) is the process of setting insurance prices
  - How much premium to charge
- Reserving is the process of estimating how unpaid loss affects ratemaking
  - Recall that loss is a part of premium



# CLAIMS AND LOSSES

- Loss is a dollar amount of compensation paid to the claimant
- Reported Loss = Paid Loss + Current Case Reserve
  - Case Reserve: estimate of the remaining money to ultimately settle the claim, can change
- Ultimate loss (or “incurred loss” for financial reporting purposes) is the amount required to settle all claims for a defined group of policies
- Estimated Ultimate Losses = Reported Loss + IBNR



# WORK THROUGH AN EXAMPLE

**Scenario:** On 02/03/2025, an insured reports a medical malpractice lawsuit, scheduled to take place on 05/03/2025. The insurer estimates that it will pay \$12,000 in legal fees and other costs, as well as an estimated \$88,000 in settlements.

1. What is the report date?
2. How much is paid as of the report date?
3. How much is in case reserves on the report date?



# WORK THROUGH AN EXAMPLE

**Scenario:** On 02/03/2025, an insured reports a medical malpractice lawsuit, scheduled to take place on 05/03/2025. The insurer estimates that it will pay \$12,000 in legal fees and other costs, as well as an estimated \$88,000 in settlements.

1. What is the report date? 02/03/2025
2. How much is paid as of the report date? \$0
3. How much is in case reserves on the report date?

$$\text{\$12,000} + \text{\$88,000} = \text{\$100,000}$$



# WORK THROUGH AN EXAMPLE

Throughout the month of April, the insurance company incurs and pays legal fees of \$10,000. The estimate of total legal fees is unchanged.

- As of 04/30/2025, how much total loss was paid?
- How much money is in case reserves on 04/30/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	?	?



# WORK THROUGH AN EXAMPLE

Throughout the month of April, the insurance company incurs and pays legal fees of \$10,000. The estimate of total legal fees is unchanged.

- As of 04/30/2025, how much total loss was paid?
- How much money is in case reserves on 04/30/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	\$10,000	\$90,000

# WORK THROUGH AN EXAMPLE

On 05/01/2025, the insured incurs, but does not pay, \$5000 of court expenses and legal fees. It is expected that no additional expenses are remaining, but still expects to pay \$88,000 in settlements.

- As of 05/01/2025, how much total loss was paid?
- How much money is in case reserves on 05/01/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	\$10,000	\$90,000
05//01/2025	?	?



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- As of 05/01/2025, how much total loss was paid?
- How much money is in case reserves on 05/01/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	\$10,000	\$90,000
05//01/2025	\$10,000	\$93,000





# WORK THROUGH AN EXAMPLE

On 05/09/2025, the insured is ordered to pay \$200,000, which is covered by the company. Additionally, the company pays the \$5,000 of expenses. The claim is then closed.

- As of 05/09/2025, how much total loss was paid?
- How much money is in case reserves on 05/09/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	\$10,000	\$90,000
05//01/2025	\$10,000	\$93,000
05/09/2025	?	?



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- As of 05/09/2025, how much total loss was paid?
- How much money is in case reserves on 05/09/2025?

Date	Paid Loss	Case Reserves
02/03/2025	\$0	\$100,000
04/30/2025	\$10,000	\$90,000
05//01/2025	\$10,000	\$93,000
05/09/2025	\$215,000	\$0



# LOSS ADJUSTMENT EXPENSE

- Loss Adjustment Expenses (LAE) are incurred by the insured in the process of settling claims
- Some are claim-specific – called allocated loss adjustment expenses (ALAE)
  - e.g. fees for hiring a lawyer
- Some are NOT claim-specific – called unallocated loss adjustment expenses (ULAE)
  - e.g. salaries for claims analysts



# UNDERWRITING EXPENSE

- Companies incur other expenses in the process of acquiring and writing policies, these are called underwriting expenses / operational & administrative expenses
- These are broken down into:
  - **Variable UW expenses:** vary with the amount of premium (commissions, taxes, etc.)
  - **Fixed UW expenses:** do not vary with premium, but varies depending on exposures/policies (marketing, client meetings, licenses, etc.)



# UNDERWRITING PROFIT

- The cost of each policy is not known at the time of sale
  - This means the insurance company is gambling on this policy not incurring any losses or expenses beyond the premiums earned
- Underwriting is essentially writing 10 accounts hoping only 1 would incur losses
  - There is no absolute way to guarantee this
- UW profit comes from two main sources
  1. Profits from individual policies (= premium - losses - expenses)
  2. Investment income is income generated by investing the funds held by the company (e.g. case reserves/unearned premium)

*Note: investment income is NOT part of the Fundamental Insurance Equation*



03

# ADVERSE SELECTION



# BALANCING THE EQUATION

- Ratemaking actuaries determine the level of premium such that the fundamental insurance equation is balance
  - Both at a macro level and individual level
- If the equation is imbalanced at a macro level, the company becomes either uncompetitive or not having enough money for claim payouts
- If the equation is imbalanced at an individual level, the company could be subject to **adverse selection**



# ADVERSE SELECTION

- Adverse selection refers to situations where insurance companies provide coverage for a risk substantially riskier than initially assumed
- Suppose there are two companies, A and B, who both offer coverage in LA (true cost \$250) and SF (true cost \$200)
- Company A priced to true cost, Company B did not price correctly at the individual level

Company	SF Exposures	SF Rate (True = \$200)	LA Exposures	LA Rate (True = \$250)	Excess Profit/Loss
A	100	\$200	100	\$250	$\$0 + \$0 = 0$
B	100	\$225	100	\$225	$\$2500 + (\$2500) = 0$





# ADVERSE SELECTION

- If 25% of the insured shop around at EOY and go with the cheapest policy, Company B will gain LA exposures and lose SF exposures
- Thus, Company B will have to increase its rates to stay in business
- If Company B decides to continue using average rate:
  - Total True Cost =  $(75 \times \$200) + (125 \times \$250) = 46,250$
  - Total Exposures =  $75 + 125 = 200$
  - Break-even rate =  $TC / TE = 46,250 / 200 = \$231.25$

Company	SF Exposures	SF Rate (True = \$200)	LA Exposures	LA Rate (True = \$250)	Excess Profit/Loss
A	125	\$200	75	\$250	$\$0 + \$0 = 0$
B	75	\$225	125	\$225	$\$1875 + (\$3125) = (\$1250)$



# ADVERSE SELECTION

- Company B now adjusts to the average rate \$231.25
- The same membership pattern will continue (lose 25% of SF exposures, gain 25% of LA exposures), forcing Company B to adjust its rates, go bankrupt, or exit out of the SF market
- Therefore, Company B experiences adverse selection because rates were not balanced at the individual level

Company	SF Exposures	SF Rate (True = \$200)	LA Exposures	LA Rate (True = \$250)	Excess Profit/Loss
A	144	\$200	56	\$250	$\$0 + \$0 = 0$
B	56	\$231.25	144	\$231.25	$\$1750 + (\$2700) = (\$950)$

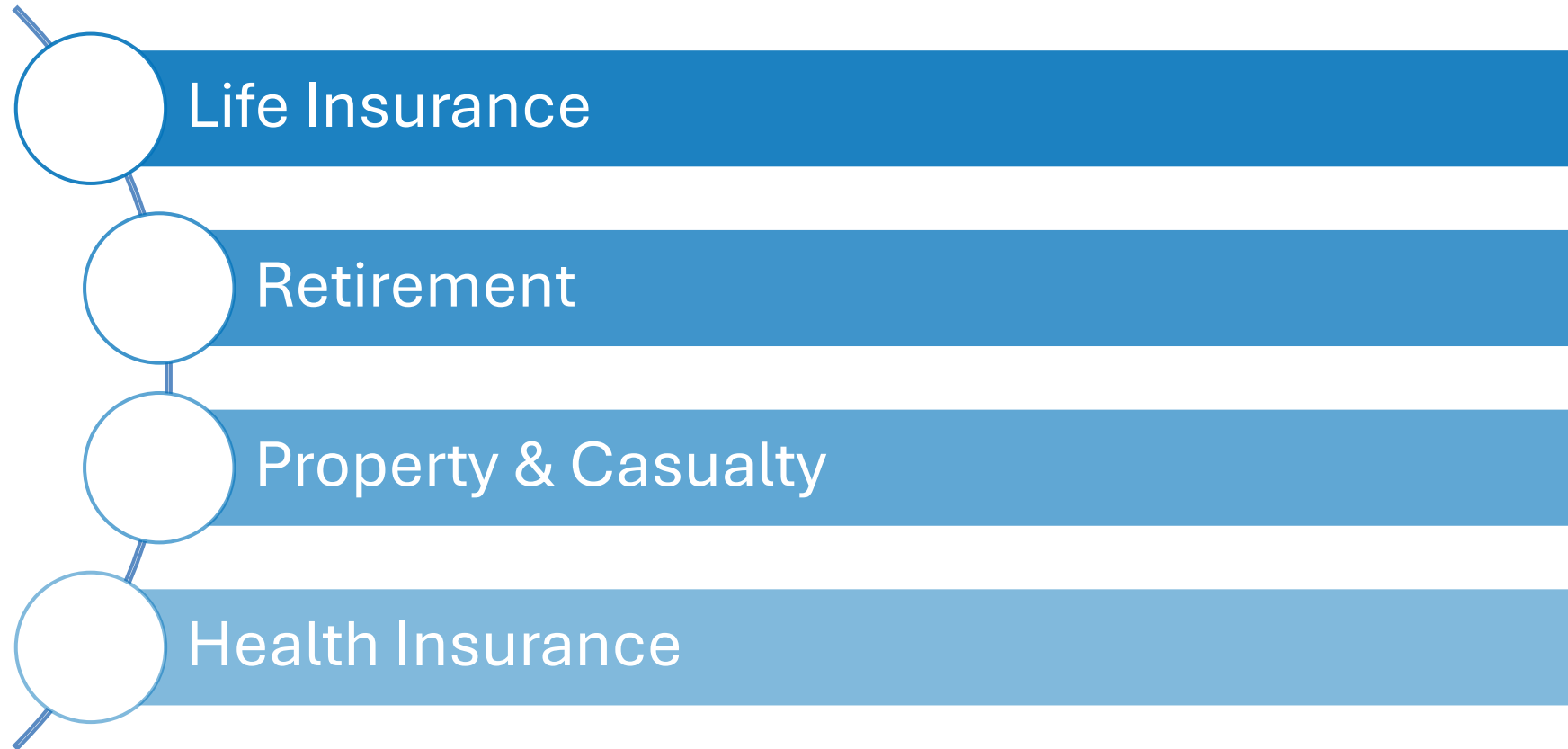


04

# COMMON INSURANCE PRODUCTS

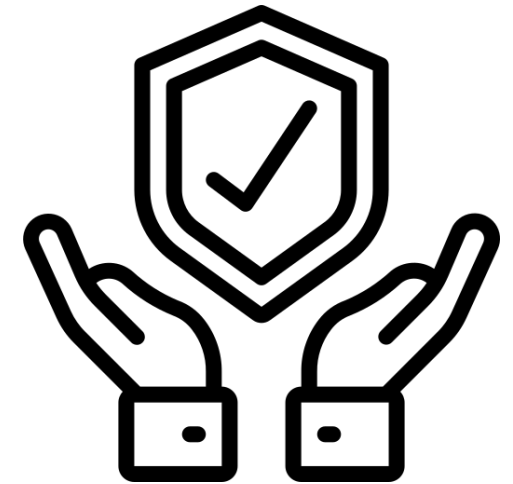


# LINES OF BUSINESS



# LIFE INSURANCE

- Insureds pay a premium, usually monthly or a fixed amount of time, and the beneficiary receives a lump sum upon the death of the insured
- Permanent life insurance: life insurance that provides coverage for life
- Term Life Insurance: the beneficiary receives a death benefit if you pass away within a fixed time
  - If the period is for 20 years and you pass away in year 21, there will be no benefit



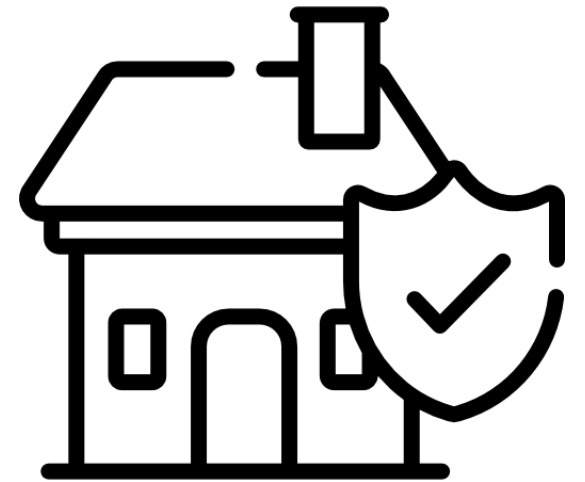
# RETIREMENT

- Two main products
  - **Defined Benefit Plan:** provides specific payment amount in retirement (e.g. pensions)
  - **Defined Contribution Plan:** allows individuals (and/or their employer) to make contributions that will be invested (e.g. 401K)
- Recently, there has been a shift from defined benefit to defined contribution plans, with the risk being shifted more onto the employee than the employer



# PROPERTY & CASUALTY

- Coverage for physical property and liabilities
- Homeowner's insurance protects a home and its belongings against events such as wildfires, arson, tornadoes, and theft
- Auto insurance protects a vehicle and its occupants from damage and liability, depending on the type of coverage
- Boats, ATVs, snowmobiles, pets, etc. can also be insured
- Also includes commercial insurance, re-insurance, cyber insurance



# HEALTH INSURANCE

- Individual & Family, Small Group (5-20 employees), Large Group (20+ employees)
- Different Types: medical, dental, vision, etc.
- Health Maintenance Organization (HMO): coverage to a fixed number of physicians and hospitals, known as the network
  - You cannot go out of your network under HMO
- Preferred Provider Organization (PPO): access to network like HMO, but also out of network care as well
  - Oftentimes more expensive





# KEY TAKEAWAYS

- Get yourself familiar with insurance terms to hold better conversations with interviewers/colleagues
- Pricing actuaries aim to avoid adverse selection and price products accurately and competitively
- Reserving actuaries aim to estimate unpaid claims to ensure insurer can pay out claims as they are submitted

# ANNOUNCEMENTS

- Mentor Sign-Ups due Sunday 11/9 @ 11:59 PM
- *Mentorship Mixer* Thursday 11/13 @ MS 6620AB



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# THANK YOU!

Any questions?

