INTRODUCTION TO INSURANCE

Oct 29, 2024

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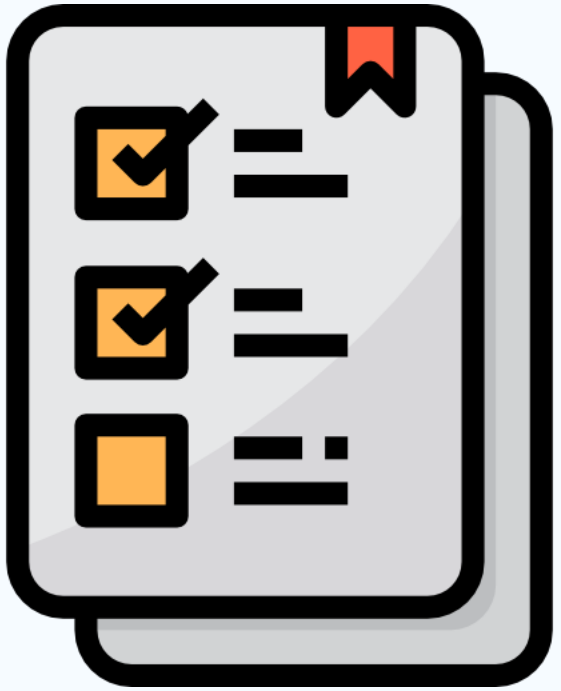
Agenda

1. Why Insurance?
2. Pricing and Reserving
3. Adverse Selection
4. Common Insurance Products



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SECTION 01

WHY INSURANCE?

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WHY INSURANCE?

- Since insurance firms are incredibly profitable, surely their payout isn't proportional to the premiums they collect?
    - Doesn't this mean that in most cases, policyholders are losing money on the premiums they paid?
- By paying a relatively small premium, policyholders don't need to keep large sums set aside for emergencies. This frees up funds for investments or other productive uses, enhancing financial flexibility!
    - Increasingly, in life insurance especially, we are seeing the emergence of investment-linked products, which provides the policyholder with an investment component on their premiums, that allows them to collect their maturity benefit at an interest to hedge against inflation.
    - There are regulations that necessitates loss ratio to be above a threshold! Therefore, it is not true that insurers can payout less.

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INTERESTING POLICY #1: TITANIC

- **The Coverage**: The Titanic was insured for £1mn by Lloyd's of London and other marine insurers.
  - This is a huge amount given that the total insured amount for all marine losses for 1912 was £6.75mn
- **Interesting Points**:
  - ***First Car Insurance Claim***: Passenger William Carter claimed $5,000 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.

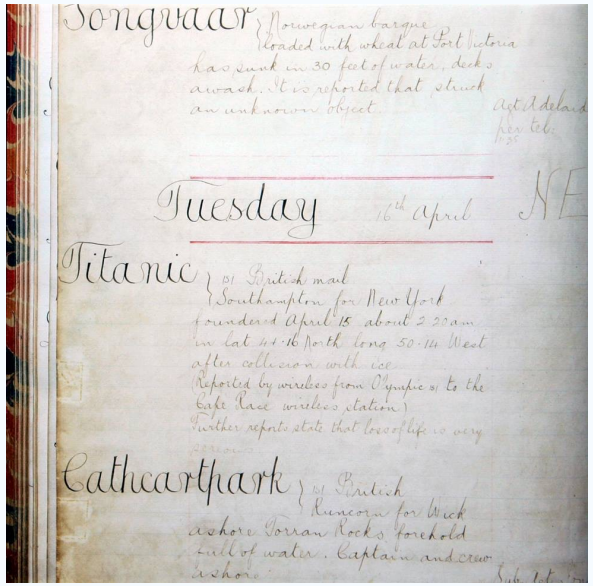
Songvaar
Tuesday
Titanic
Cathcarthark

Figure 1: Famous entry of Titanic's collision in Llyod's Loss Books

INTERESTING POLICY #2: CELEBRITY

- **Concept**: Many celebrities insure specific body parts that are central to their public image and career. This protects them financially if an injury or disability affects their ability to perform or maintain their brand.
- **Why Body-Part Insurance?**
  - In professions where physical attributes are closely tied to income, celebrities face risks that can impact their earnings and reputation.
  - This coverage allows them to manage the financial risk of injuries that might require extensive recovery time or impact their brand.
- **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 $40mn. 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.

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SECTION 02

PRICING AND 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 units of risks that underlie insurance premium
  - 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.

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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. During this period, coverage remains active.

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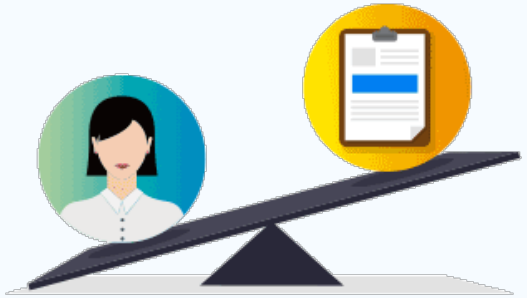
COST SHARING TERMINOLOGIES



Jane pays **100%**

Her plan pays **0%**

Jane hasn't reached her $1,500 deductible yet

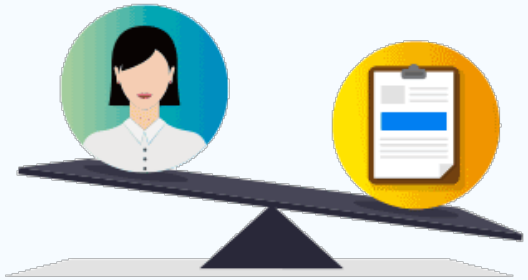
Her plan doesn't pay any of the costs.

Office visit costs: $125

Jane pays: $125

Her plan pays: $0

more costs



Jane pays **20%**

Her plan pays **80%**

Jane reaches her $1,500 deductible, co-insurance begins

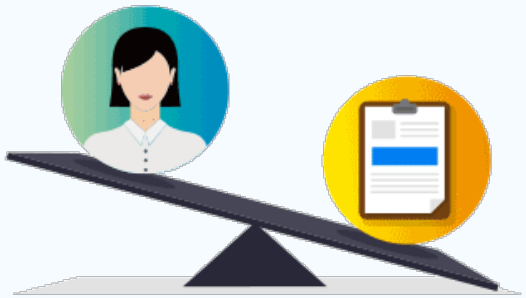
Jane has seen a doctor several times and paid $1,500 in total. Her plan pays some of the costs for her next visit.

Office visit costs: $75

Jane pays: 20% ng $75 = $15

her plan pays: 80% ng $75 = $60

more costs



Jane pays **0%**

Her plan pays **100%**

Jane reaches her $5,000 out-of-pocket limit

Jane has seen the doctor often and paid $5,000 in total. Her plan pays the full cost of her covered health care services for the rest of the year.

Office visit costs: $200

Jane pays: $0

Her plan pays: $200

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EXPOSURES AND PREMIUMS

Exposures and premium can be measured in the following ways:

- **Written:** total exposures arising from policies written during a specified 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

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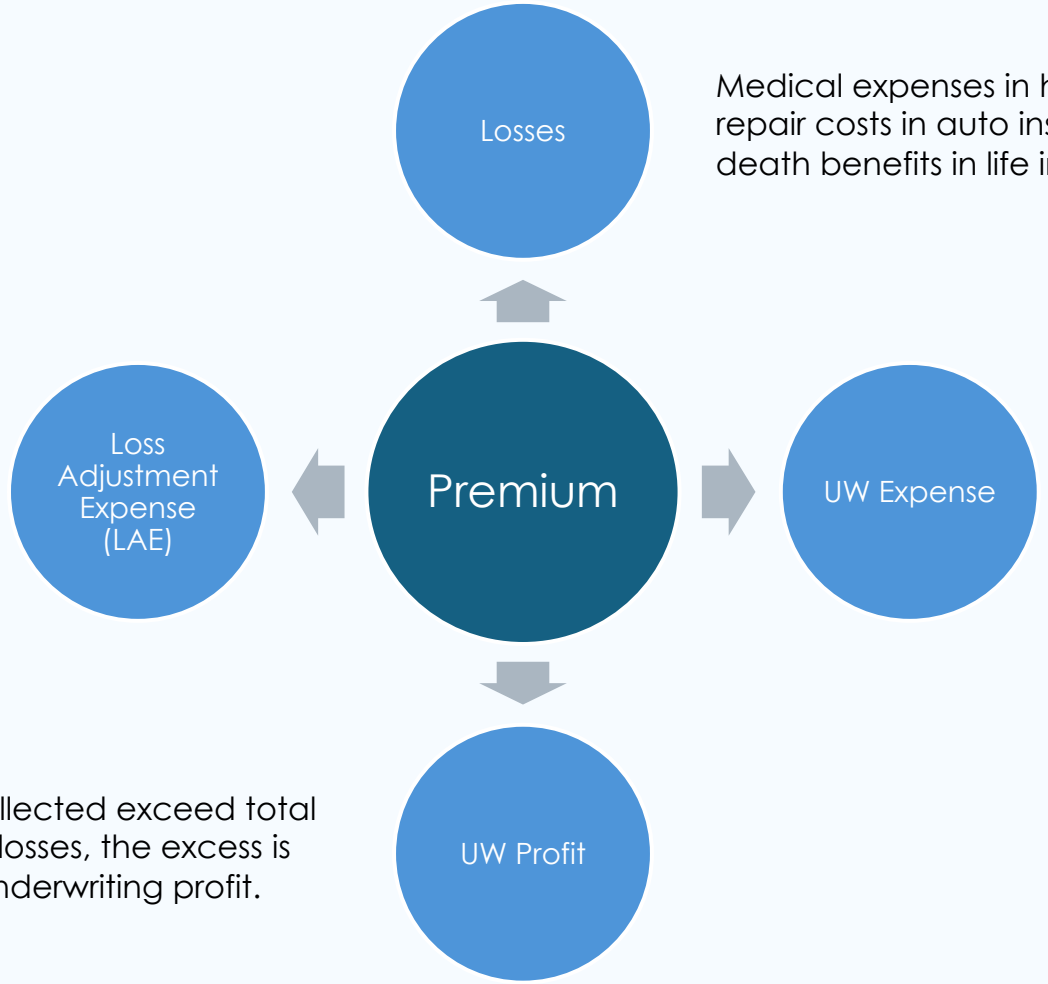
FUNDAMENTAL INSURANCE EQUATION



Medical expenses in health insurance, repair costs in auto insurance, or death benefits in life insurance.

Fees for claims adjusters, cost of hiring investigators for fraud detection, and legal fees if claims are contested.

Salaries of actuarial analysts and risk assessors, marketing costs to acquire customers, and administrative costs.

If premiums collected exceed total expenses and losses, the excess is recorded as underwriting profit.

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IBNR CLAIMS

- 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 incurred but not reported (IBNR) claims
- **Example**: A person might be injured in a car accident but delay 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.

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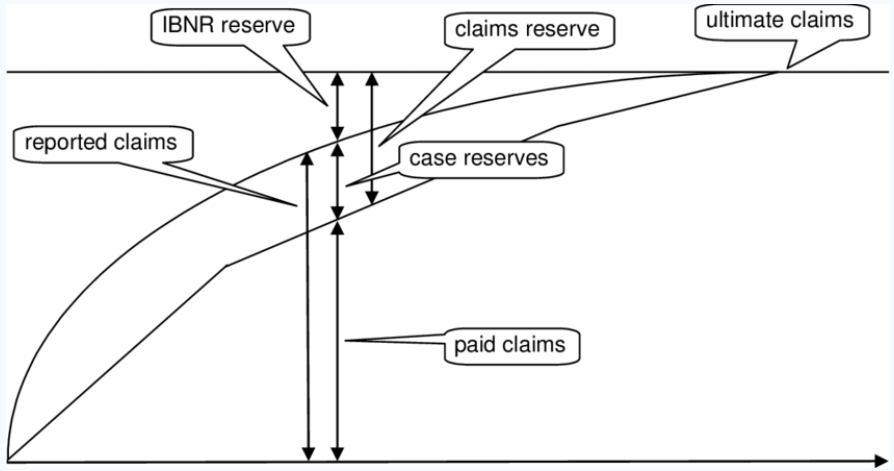
CLAIMS AND LOSSES

- Loss is $ amount of compensation paid to the claimant
- Losses on reported claims are split:
  - Paid losses
  - Case Reserve: estimate of the remaining money to ultimately settle the claim, can change
  - Reported Loss = Paid Loss + Current Case Reserve
  - 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



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WORK THROUGH AN EXAMPLE!

On 2/3/2023, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2023. The insurer estimates that it will pay $12,000 in legal fees and other costs, as well as an estimated $88,000 in settlements.

- What is the report date?
- How much is paid as of the report date?
- How much is in case reserves on the report date?

WORK THROUGH AN EXAMPLE!

On 2/3/2023, an insured reports a medical malpractice lawsuit, scheduled to take place on 5/3/2023. The insurer estimates that it will pay $12,000 in legal fees and other costs, as well as an estimated $88,000 in settlements.

- What is the report date? 2/3/2023
- How much is paid as of the report date? $0
- How much is in case reserves on the report date? $12,000 + $88,000 = $100,000

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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 4/30/2023, how much losses were paid in total?
- How much money is in case reserves on 4/30/2023?

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	???	???

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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 4/30/2023, how much losses were paid in total? $10,000
- How much money is in case reserves on 4/30/2023? $90,000

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000

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WORK THROUGH AN EXAMPLE!

On 5/1/2023, the insured incurs, but does not pay, $5,000 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 5/1/2023, how much losses were paid in total?
- How much money is in case reserves on 5/1/2023?

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000

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WORK THROUGH AN EXAMPLE!

On 5/1/2023, the insured incurs, but does not pay, $5,000 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 5/1/2023, how much losses were paid in total? $10,000
- How much money is in case reserves on 5/1/2023?
  $5,000 (estimated expense) + $88,000 = $93,000

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000

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WORK THROUGH AN EXAMPLE!

On 5/9/2023, 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 5/9/2023, how much losses were paid in total?
- How much money is in case reserves on 5/9/2023?

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000

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WORK THROUGH AN EXAMPLE!

On 5/9/2023, 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 5/9/2023, how much losses were paid in total?
  $10,000 + $5,000 + $200,000 = $215,000
- How much money is in case reserves on 5/9/2023? $0 (Claim closed)

Date	Paid Loss	Case Reserve
2/3/2023	$0	$100,000
4/30/2023	$10,000	$90,000
5/1/2023	$10,000	$93,000
5/9/2023	$215,000	$0

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LOSS ADJUSTMENT EXPENSE

- Loss Adjustment Expenses are incurred by the insured in the process of settling claims
- Some are claim-specific. These are called allocated loss adjustment expenses (ALAE).
    - e.g. fees for hiring a lawyer
- Some are NOT claim-specific. These are 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, lunch/dinner, licenses, etc.)

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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.
- The art of underwriting is essentially writing 10 accounts hoping only 1 would incur losses – but there is no absolute way to guarantee this
- - UW Profit comes from TWO main sources:
  - Underwriting profit, or operating income, is the sum of profits generated from individual policies (PREMIUM – LOSSES – EXPENSES)
  - Investment income is income generated by investing the funds held by the company (e.g. case reserves/unearned premium)

Investment income is not part of the Fundamental Insurance Equation!

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SECTION 04

ADVERSE SELECTION

BALANCING THE EQUATION

- Ratemaking actuaries determine the level of premium such that the fundamental insurance equation is balanced, both in a macro level and the individual level.
- If the equation is imbalanced in 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 refers to situations where insurance companies provide coverage for a risk substantially riskier than initially assumed.

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ADVERSE SELECTION

- Suppose there are 2 companies, A and B, which offer coverage in 2 major cities
- Suppose the true cost of SF is $200 and true cost of LA is $250
- Company A priced to true cost. Company B did not price correctly at the individual level.

Company	SF Exposures	SF Rate (True rate = $200)	LA Exposures	LA Rate (True rate = $250)	Excess Profit/Loss
A	100	$200	100	$250	$0 + $0 = 0
B	100	$225	100	$225	$2250 + ($2250) = 0

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ADVERSE SELECTION

- If 25% of the insureds shop around at EOY, and they go with the cheapest policy, company B will gain LA exposures and lose on SF
- Thus, company B will have to increase its rates to stay in business.
  - Should company B decide to continue using its average rate, the amount would be $231.25

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

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ADVERSE SELECTION

- Now, company B decides to use an average rate of $231.25
- They will continue seeing the same pattern in membership, which resulted in a loss. This process continue until company B adjust its rates, goes bankrupt, or completely exiting out of SF territory

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

- This is an example of adverse selection and demonstrates why rates must be balanced at the individual level.

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SECTION 05

COMMON INSURANCE PRODUCTS

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
- Term life insurance: the beneficiary receives a death benefit if you pass away with a fixed time (e.g., 20 years). If you pass away in year 21, there will be no benefit.
- Permanent life insurance: life insurance that provides coverage for life

RETIREMENT

- 2 main products: defied benefit and defined contribution plans
  - Defined Benefit Plan provide a specified payment amount in retirement (e.g. pensions)
  - Defined contribution plans allow an individual (and/or their employer) to make contributions that will be invested (e.g. 401K)
- Recently, there has been a shift from defined benefit to defied contribution plans, with the risk being shifted more onto the employee than the employer.

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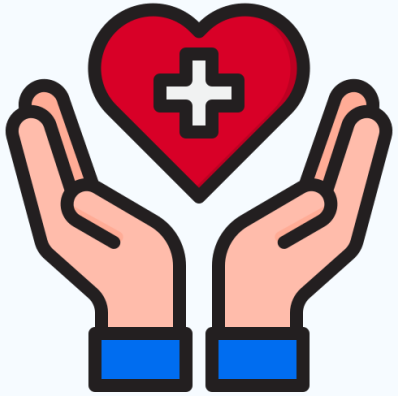
PROPERTY & CASUALTY

- This type of insurance provides coverage to physical property and cover liability
- Homeowner insurance protects a home and its belonging against event such as wildfire, 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 – this makes P&C risks become diverse
- Commercial insurance, re-insurance, cyber insurance, excess and surplus

HEALTH INSURANCE

- Individual & Family, Small Group (5-20 employees), and Large Group(20+ employees)
- Different type: 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 are more expensive



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KEY TAKEAWAYS

- It is important that you are familiar with insurance terms and can hold a conversation with your 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 payout claims as they are submitted.


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ANNOUNCEMENTS

- Basic Excel Workshop on Tuesday 11/5 @ MS 6627
- Mentorship mixer coming up soon! Keep a look out on your emails
- Winter Case Competition in January – use Winter Break to brush up on technical skills

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THANK YOU

Any questions?

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