



A Program of The Actuarial Foundation

Modeling the Future Challenge

Basic Training Scenario
Mobile Phone Insurance

Mobile Phone Insurance Introduction

Insurance is a guarantee to reimburse or pay for items according to terms setup in a written agreement or policy.

Any property or product may be protected by insurance.



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Mobile Phone Insurance Introduction

What are some common areas of insurance that you are aware of?

Some Common Insurance Areas:

1. Health
2. Automobile
3. Home/Property
4. Life



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Mobile Phone Insurance Scenario

The new Zest 2 mobile phone was launched a year ago today and sells for \$700. You have been hired by Alpha Insurance Co. to analyze how selling a warranty for the new Zest 2 phone would be valuable for them, and for their customers (the phone owners). Alpha Co. is exploring providing an optional 1-year warranty for \$100. This is the insurance policy's “**premium,**” or the value paid to purchase the policy.



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Mobile Phone Insurance Scenario

We can analyze the mobile phone insurance offered from both the policy holder and the insurance company's perspectives. Alpha Co. wants to make sure they have a profitable policy for them, that also provides adequate and valuable coverage for their customers – the policy holders.



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Part 1: Company Perspective Basics

Mobile Phone Insurance Scenario

Is a \$100 premium an appropriate price for Alpha Co. to sell the phone warranty at?

What additional information do you need to answer this question?



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Mobile Phone Insurance Scenario

Is the \$100 premium an appropriate price for the warranty?

What is the expected *loss payment* for the insurance company?

Cost to replace phone: \$700

Due to extreme damage.

Probability= 0.02

Phone is lost/stolen.

Probability= 0.03

Average cost to fix phone: \$100

Fixable damage to phone.

Probability= 0.45



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Mobile Phone Insurance Scenario

Is the \$100 premium an appropriate price for the warranty?

What is the expected *loss payment* for the insurance company?

$$\begin{aligned} & \$700 * (0.02 + 0.03) + \$100 (0.45) \\ & \quad = \mathbf{\$80} \end{aligned}$$

On average the company will pay out \$80 per \$100 in premium. This is a *loss ratio* of 80%.



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Mobile Phone Insurance Scenario

Is the \$100 premium an appropriate price for the warranty?

Now your boss at Alpha Co. provides you with some additional information about their expenses.

- Operational Expenses = \$10 / policy.
- Commission = \$5 / policy

The **Combined Ratio** = $(\text{Loss} + \text{Expense}) / \text{Premium}$.
This is a valuable metric to analyze policies.

Calculate the “Combined Ratio” to analyze if the \$100 premium from Alpha Co. is appropriate.



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Mobile Phone Insurance Scenario

What is the actual profit to the insurance company?

	Income	Expense
Policy Premium	\$100	
Expected loss		\$80
Operational Expenses		\$10
Commission		\$5
TOTAL:	\$100	\$95



This is the **Combined Ratio**:

$$(\text{Loss} + \text{Expense}) / \text{Premium} = 95\%$$



Part 2: Introducing Deductibles & Co-Pays

Mobile Phone Insurance Scenario

A **Deductible** is an amount the policy holder must cover before the insurance company pays.

A **Co-Pay** is an amount the policy holder pays on each loss during the term of the policy, while the insurance company pays the remainder.



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Mobile Phone Insurance Scenario

Why might a deductible, or Co-pay be important in creating an insurance policy?



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Mobile Phone Insurance Scenario

The Alpha Insurance Co. CEO wants to maintain a 95% combined ratio on the Zest Phone policies but also wants to include a \$50 deductible on the policy to make sure the policy holders have “skin in the game”

What is the appropriate policy premium Alpha Co. should charge to maintain it's 95% combined ratio?

Expected Loss with deductible = $(\$700 - \$50) * (0.02 + 0.03) + (\$100 - \$50) (0.45) = \$55$

Premium = $(\$55 + \$15) / 0.95 = \mathbf{\$73.68}$



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Mobile Phone Insurance Scenario

Now, what if the Alpha Co. CEO negotiates a commission with Zest Phones of 5% of the policy premium instead of a flat \$5. They still want to have the profit be 5% of the premium (a 95% Combined Ratio) and to keep a \$50 deductible on the policy to make sure the policy holders have “skin in the game.”

What is the appropriate policy premium here?

$$\text{Profit} = 5\% * \text{Premium}$$

$$\text{Profit} = \text{Premium} - \text{Expected Loss} - \text{Expenses}$$

$$\text{Expected Loss} = \$55 \text{ (the loss with the deductible)}$$

$$\text{Expenses} = \$10 + 0.05 * \text{Premium}$$

$$\text{Premium} = \$72.22$$



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Mobile Phone Insurance Scenario

Alpha Co's CEO now provides you with additional information, breaking down what we know about the 45% chance of needing to repair the phone. In addition to knowing that the overall average cost of fixing a phone is \$100 and that there is a 45% chance of needing to do this, we now know that 25% of these people have repairs that cost \$152 dollars on average.

What is the average cost of repairs for the other 20% who need repairs?

$$\$100 = 0.2 / 0.45 * X + 0.25 / 0.45 * \$152 \text{ so } X = \$35$$



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Mobile Phone Insurance Scenario

Alpha Co's CEO now provides you with additional information, breaking down what we know about the 45% chance of needing to repair the phone. In addition to knowing that the overall average cost of fixing a phone is \$100 and that there is a 45% chance of needing to do this, we now know that 25% of these people have repairs that cost \$152 dollars on average.

Now knowing that the average repairs are actually that 25% = \$152 loss and 20% = \$35 loss, what is the Expected Loss on Alpha Co.'s policy with the \$50 Deductible?

$0.05 \times \$650 + 0.2 \times \$0 + 0.25 \times (\$152 - 50) =$
\$58 expected claim costs.



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Part 3: Policy Holder Perspective

Mobile Phone Insurance Scenario

Consider the situation where you absolutely need to have a phone. So if you lose, or damage your phone, you will be forced to purchase a new one. Calculate the Expected Cost of your phone/s if you **DO NOT** buy the insurance, considering the same likelihood of loss, theft, or damage as before.



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Mobile Phone Insurance Scenario

Consider the situation where you absolutely need to have a phone. So if you lose, or damage your phone, you will be forced to purchase a new one. Calculate the Expected cost of your phone/s if you **DO** buy the insurance.



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Mobile Phone Insurance Scenario

Your “Expected Costs” with purchasing the warranty are more than without purchasing it. So what are some reasons a person might see purchasing the Zest Phone warranty to be a good idea?

1. Stabilize cash flow. Buying insurance spreads cost throughout the policy period and **eliminates volatility**.
2. Peace of mind. Some people are risk adverse and will pay to **not have the risk**.
3. You may believe you are **riskier than the average person**.
4. The insurance company may **offer additional services** in conjunction with policy.



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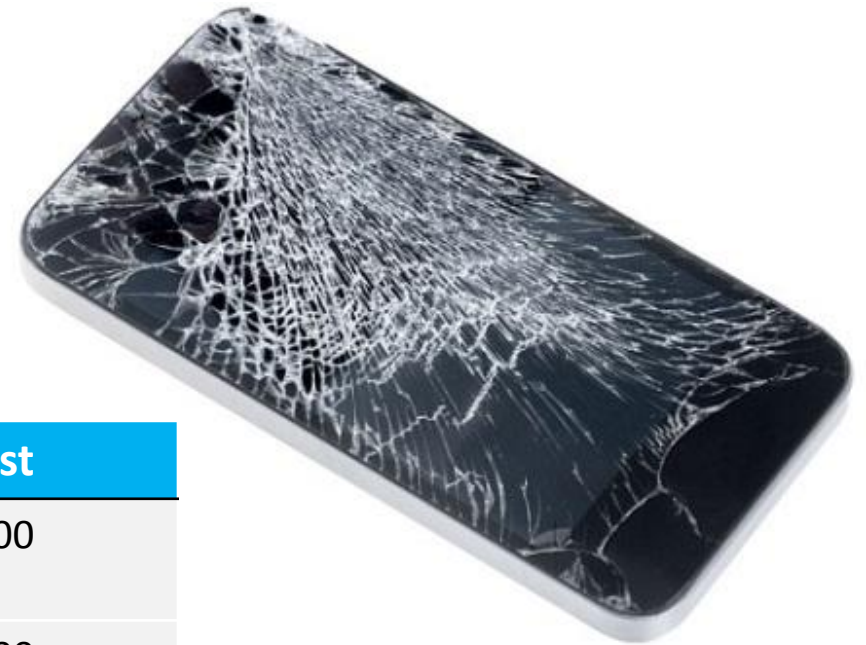
Part 4: Understanding Segmentation

Mobile Phone Insurance Scenario

Alpha Insurance Co. provides you with new data about the probabilities of male versus female policy holders. Alpha Co's data shows that females are slightly less prone to loss or theft of their phones while males are more prone to these losses.

Calculate the Expected value of loss for males vs. females.

	Male	Female	Avg. Prob.	Cost
Replacing due to extreme damage	0.03	0.01	0.02	\$700
Replacing due to theft or loss	0.05	0.01	0.03	\$700
Repairing phone due to damage	0.45	0.45	0.45	\$100



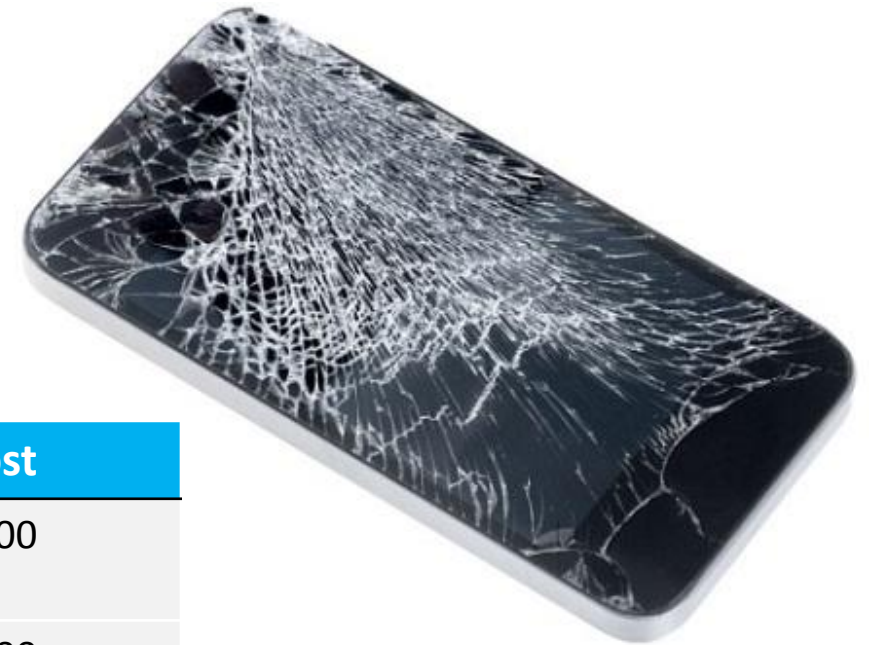
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Mobile Phone Insurance Scenario

Alpha Insurance Co. provides you with new data about the probabilities of male versus female policy holders. Alpha Co's data shows that females are slightly less prone to loss or theft of their phones while males are more prone to these losses.

How could Alpha Co. use this information to provide better insurance policies?



	Male	Female	Avg. Prob.	Cost
Replacing due to extreme damage	0.03	0.01	0.02	\$700
Replacing due to theft or loss	0.05	0.01	0.03	\$700
Repairing phone due to damage	0.45	0.45	0.45	\$100
Expected Losses	\$101	\$59	\$80	

Mobile Phone Insurance Scenario

Now, imagine there are two companies offering phone warranty policies: Alpha Co., and Bravo Insurance.

Alpha Co. offers everyone a policy at \$100.

Bravo Co. offers males a policy at \$120 and females a policy at \$80.

What will happen over time to the expected losses for Alpha Co. versus Bravo Co.?

Female policy holders (the less risky people) will go to Bravo Insurance, while males (the more risky people) will stay at Alpha Co. This is called **Adverse Selection** and demonstrates why insurance companies need to have well segmented policy rates.



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Mobile Phone Insurance Scenario

How is Bravo Insurance able to provide two different prices for the same product?

- By investigating the costs of claims by insured type and finding a meaningful variable to predict losses. Once the variable is known, it can be used to charge different prices to insureds with different risk potential.



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Mobile Phone Insurance Scenario

What else besides policy pricing could cause adverse selection?

- Difference in cost of the claims, instead of probability of claims occurring.
- Instead of pricing, marketing may be attracting the lower than average risks.



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Mobile Phone Insurance Scenario

You now understand many of the basics of insurance pricing! For more in-depth analyzes and questions, consider exploring additional scenarios on: www.mtfchallenge.org

And make sure to review the information and prepare for the full Modeling the Future Challenge projects!



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