

2019-20 Example Scenario

Flood Insurance Instructor Guide



A program of The Actuarial Foundation

**Modeling The Future
Challenge**



Introduction

In this scenario, you have been hired as a consulting actuary by Sphinx Flood Insurance, a mutual insurance company based in Chicago, Illinois. Each year, Sphinx insures 7,000 households across the Midwest with 1-year term policies that cover water damage to the structure. Sphinx is reinsured by the National Flood Insurance Program (NFIP) under the Federal Emergency Management Agency. Sphinx has hired you to analyze their flood claims from last year in an effort to better price their insurance products and help protect families in the flood-prone states of the Midwest. Sphinx currently insures home-owners in the states of Iowa, Illinois, Missouri, Kansas, and Nebraska.

Data summary:

Sphinx has provided you with data on 7,000 of their losses from written policies in the last year, cleaning the data from any policyholders who did not have a claim. All households are located within Iowa, Illinois, Missouri, Kansas, or Nebraska, and policies were written uniformly across each state (1400 each). Households are classified by their policy ID number, the elevation of their home (in feet), as well as by indication if they have preventative measures against flooding (i.e. sump pumps,).

Use the data in the attached spreadsheet to answer the questions provide and help the Sphinx Flood Insurance CEO make decisions about how to update or add to their insurance policies.



Level 1 Questions: Basic Statistics Probability

1. Of those with a claim, what is the average claim amount for policyholders in each state?
2. If a Nebraska policyholder did not have preventative measures installed in their home, what is the probability that they had a claim over \$14,000 last year, given they had a loss?
3. In Illinois, what is the difference between the expected loss of a policyholder who has preventative protection installed and the expected loss of a policyholder who does not have any preventative measures installed?
4. What is the variance of elevation in each state? (Hint: You have all of the claims data, so use the population variance)



Level 3 Questions: Risks & Insurance

For insurance companies there are several ways of making sure they will be able to cover all expected losses in a given year. The “premium” is the base amount a policyholder must pay (either annually or monthly). A loading charge is an additional percentage increase in a base premium designed to cover overhead expenses for the insurance company. A yearly fee is another method of recovering expenses which adds a standard fee for each policy. Companies may also consider having a co-pay for any claim – meaning the policyholder must pay a certain percentage of the claim. Companies also include deductibles which are dollar amounts that must be met before the insurance will pay the rest of the claim.

16. Assuming 35% of Nebraska policyholders had a loss last year, if all premiums are the same, what is the minimum premium that should be charged per month in the state to cover the expected losses if that is the only fee the insurance company gathers from the policy holder?

17. What is the minimum premium required if there is also a 10% annual charge on the expected losses in Nebraska and \$200 yearly fee on every policy?

18. Elevation is one variable that can be considered in defining the risk of a particular home in how likely it may be to flood; however, this is not very strongly correlated to loss. What other variables might you recommend Sphinx track in the future to have a better understanding of how risky a potential policy holder is?

19. If all other variables stayed the same and the likelihood of severe storms were to increase 10% throughout the region, in written, general terms, what would you expect to happen to:

1. The average claim value:
2. The number of claims:
3. The average premium Sphinx would need to charge to break-even.



Level 4 Questions: Critical thinking recommendations

20. Suppose Sphynx wants to start selling flood insurance in Idaho. Should they use their data on losses in the Midwest to determine the new rates? Why or why not? Use data to justify your answer.
21. What bias may be present in a model based on this data alone? Explain your reasoning.
22. Sphynx is considering writing more policies. Does it make more sense to write them in states where they already write policies, or expanding their business into new states? Why? If they were to write more policies in Iowa, Illinois, Missouri, Kansas, or Nebraska, which state should they choose and why?
23. Based on this data, do you think it's more profitable to use a rate based on elevation instead of a flat rate for each state? What are the limitations of using a rate based on elevation alone?
24. An average sump pump costs a policyholder \$500 to purchase and install. Sphynx wants to implement a nationwide discount program that reimburses policyholders for installing a pump. If 72.5% of policies did not have a loss last year and Sphynx charges a \$220 flat annual fee and a 12% yearly loading charge for each policy. If the company is willing to reduce the loading charge by 8% for six months if a policyholder installs a pump and reduce the annual fee by \$20 for the next six years, what percentage of the pump cost will policyholders ultimately have to pay?



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