What is an Actuary?

An Honors Thesis (HONRS 499)

by

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Abstract

The career of an actuary, although it is considered one of the best jobs in America, is relatively unfamiliar to most people, especially high school students considering their options in Universities and fields of study. Therefore, I have created an informative presentation about the actuarial career which will introduce mathematically-minded high school students to the field of Actuarial Science. I have also developed an insurance simulation which will help students understand basic but essential actuarial methods in conditional probability and pricing based on past experience.

Acknowledgements

I would like to thank Mr. Gary Dean not only for advising me throughout this project but also for unknowingly being an inspiration throughout my academic career at Ball State in my pursuit of a career as an actuary. His encouraging attitude and critiques have helped me immensely in developing my presentation.

I would also like to thank Mrs. Doris Givan for being instrumental in my formative mathematical years and in helping me schedule my presentation with other high school teachers.

Finally, I would like to thank my roommates, my boyfriend and my parents for their patience and encouragement as I finished my thesis.
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**Also Enclosed**

I have also included a flash drive containing an electronic copy of my PowerPoint presentation and the Insurance Simulation file.
Author's Statement

Background:

When I began considering various universities and fields of study during my senior year of high school, I had no idea what I wanted to pursue. Luckily, my guidance counselor suggested Actuarial Science, and, as I approach my graduation from Ball State, I cannot think of a major I would rather study. However, one drawback I have found in my four years as an Actuarial Science major is that very few people actually know what an actuary is. Therefore, I have decided to dedicate my senior thesis to developing an informative and interactive presentation for high school students about the exciting and rewarding field of Actuarial Science.

Presentation Part One: What is an Actuary?

I will begin my presentation with a short but informative PowerPoint presentation to get the students interested in the actuarial field. My first slide, titled “What is the Best Job in America?” is meant to catch the students’ attention and foster interest in a field that they may have never heard of. I will start by posing the question, “What is the best job in America?” After a few answers, I will reveal the remainder of the slide, showing students that actuary has been consistently ranked as one of the top jobs in America. Once the students are interested, I will continue with information about what actuaries do, their average level of compensation, the hiring outlook for actuaries, and their work environment. A copy of my introductory PowerPoint presentation is enclosed with information sources cited below each slide, and an electronic copy is available on the enclosed flash drive.

Presentation Part Two: Bayes’ Theorem

After we have briefly discussed what actuaries do, I will illustrate a theorem that is essential to pricing and will help students understand the pricing simulation better. First, the students will need to understand the following:

- The reason pricing insurance is so challenging is that unlike other goods, the cost of insurance to the company is unknown when the product is sold. If a company were to sell a tee-shirt, for example, the company already knows how much all of the raw materials and labor cost and can easily price the shirt to ensure a desired profit. However, because an insurance contract is not a tangible good but instead a promise to pay in the event of a claim, the total cost can only be estimated when the good is sold.
- Actuaries have many methods of calculating the expected cost of an insurance policy. Generally, a prospective insured person is rated on factors such as gender, age, driving record, and even credit score so the insurance company can determine what type of driver the insured is likely to be. This will tell the company how many accidents the prospective insured is expected to have, therefore allowing actuaries to more accurately estimate the total cost of the policy. Historical
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data shows strong relationships between these rating factors and the safeness of the driver. For example, males have historically been more dangerous drivers.

- Bayes’ Theorem is the essential link which allows actuaries to use historical data to determine the probability of future events. It is used to calculate inverse probabilities. If the probability of A given B is known and the probabilities of A and B are known as well, Bayes’ Theorem allows one to calculate the probability of B given A using the following relationship:

\[
Pr(B|A) = \frac{Pr(A|B) \cdot Pr(B)}{Pr(A)}
\]

Because I think Bayes’ Theorem is most easily understood with a picture, I will draw the following on the board to teach the students Bayes’ Theorem:

As illustrated, an imaginary insurance company knows their distribution of drivers: one fourth are poor drivers, half are average drivers, and one fourth are good drivers. Given the company’s historical data, the percentage males and females of each type of driver have been determined as illustrated above. For the above insurance company, for example, of all insured persons who fell into the “poor driver” category in the past, 70% were male, and 30% were female. Of all of the “good drivers” in the past, 40% were male, and 60% were female. Using Bayes’ Theorem, I will show students how to calculate the probability that an insured is a poor driver, given that he is male. The probability that a prospective insured will be a poor driver, given that he is male, can be found using the following equation:
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\[
\Pr(\text{Poor Driver}|\text{Male}) = \frac{\Pr(\text{Male}|\text{Poor Driver}) \cdot \Pr(\text{Poor Driver})}{\Pr(\text{Male})}
\]

So to calculate the probability that an insured is a bad driver given that he is male, we will multiply the probability that an insured is a male given that he/she is a poor driver by the probability that an insured is a poor driver. This product will then be divided by the overall probability that an insured is male, giving us the following result:

\[
\Pr(\text{Poor Driver}|\text{Male}) = \frac{.7 \cdot .25}{.5}
\]

Therefore, the probability that an insured will be a poor driver given that he is male is 35%. The probability that he is an average driver is 45%, and the probability that he is a good driver is 20%. Using this information, the insurance company can better estimate the expected cost of insurance for the male driver and price his premium accordingly. After explaining this to the students, I will ask them to calculate a few more probabilities, such as the probability that a future insured will be a good driver given that she is female, to ensure they have grasped the concept of Bayes’ Theorem.

Once students understand Bayes’ Theorem and the idea of conditional probabilities, I will explain that the practice of rating an insured on personal characteristics—as simplified in the previous example—is used in more complex rating plans which take into account multiple characteristics to calculate the expected cost, and later the required premium, for each individual insured.

Presentation Part Three: Insurance Simulation

Using Bayes’ Theorem, I have constructed an insurance simulation which will teach students the importance of rating based on experience. I will begin by handing out dice, which will represent the type of driver of each student. I will consider rolling a six or higher having an accident. Therefore, the more sides a student’s die has, the higher their probability is of having an accident. There are four different types of dice in my simulation: a standard six-sided die, which represents a good driver; an eight-sided die, which represents an average driver; a ten-sided die, which represents a poor driver; and a twelve-sided die, which represents a dangerous driver.

If a six or higher is considered an accident, then with each roll of the die, the probabilities of an accident for the six-, eight-, ten-, and twelve-sided dice are .1667, .375, .5, and .583, respectively. Each student will choose a die at random, thus determining which type of driver they will be for the experiment. Just as an insurance company knows its distribution of drivers, I know the distribution of the dice I will hand out: .375 are six-sided, .125 are eight-sided, .375 are ten-sided, and .125 are twelve-sided. This distribution was simply chosen because I only had five of the eight-sided and twelve-sided dice, and I wanted to make sure I had enough dice for forty students.

I included an electronic copy of my simulation on the enclosed flash drive for reference and to show the calculations. My simulation will consist of three years. Each student will roll his or her die four times to represent one year. The “worst drivers,” students with twelve-sided dice, will experience more accidents than the “best drivers,” or students with six-sided dice. In the beginning, I will tell
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students that they all must pay the same amount for insurance, $1,500. This amount was chosen by calculating the expected cost to the insurance company for each policy and rounding up to the nearest multiple of 50. For each roll of a six-sided die, the probability of an accident is .1667. So for an entire year, or four rolls of the six-sided die, the expected number of accidents is .1667*4 = .667. Using the same methodology, the expected number of accidents in one year for the eight-, ten-, and twelve-sided dice are 1.5, 2, and 2.333, respectively. To calculate the expected number of accidents for each student without any knowledge of which die they hold, I will use the following equation:

\[
\text{Exp(Accidents)} = \text{Exp(Accidents}\mid\text{Die = 6}) \cdot \Pr(\text{Die = 6}) \\
+ \text{Exp(Accidents}\mid\text{Die = 8}) \cdot \Pr(\text{Die = 8}) \\
+ \text{Exp(Accidents}\mid\text{Die = 10}) \cdot \Pr(\text{Die = 10}) \\
+ \text{Exp(Accidents}\mid\text{Die = 12}) \cdot \Pr(\text{Die = 12})
\]

Therefore, the expected number of accidents for each student without having any information about the die they hold is:

\[
\text{Exp(Accidents)} = (0.667 \cdot 0.375) + (1.5 \cdot 0.125) + (2 \cdot 0.375) + (2.333 \cdot 0.125) = 1.479
\]

For the sake of simplicity for this experiment, we will assume that each accident results in a claim of $1,000 to the insurance company. Therefore, before any information is known about the die each student holds, or the type of driver they are, the expected cost for each insurance policy is $1,000*Expected Number of Accidents = $1,479, and each student’s premium will be $1,500 for the first year.

Next, each student will “drive” for one year (roll their die four times). After the first year of the experiment, I will calculate the probabilities that each student is a dangerous driver, a poor driver, an average driver, and a good driver given their number of accidents in year one using Bayes’ Theorem. For example, after the first year of “driving,” if a student has had zero accidents, the probability that a student is a “good driver” (has a six-sided die) can be found using the following equation:

\[
\Pr(\text{Die = 6}\mid\text{Accidents = 0}) = \frac{\Pr(\text{Accidents = 0}\mid\text{Die = 6}) \cdot \Pr(\text{Die = 6})}{\Pr(\text{Accidents = 0})}
\]

The probability that a student has zero accidents in a year given that he/she has a six-sided die is the product of the probability that each individual roll produces no accidents. Since a six or higher is considered an accident, there is only a 1/6 chance that a student will have an accident with each roll, and a 5/6 chance that a six-sided die will produce no accident. So the probability that a six-sided die will produce zero accidents in one year (four rolls of the die) is:

\[
\Pr(\text{Accidents = 0}\mid\text{Die = 6}) = \frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = 0.4823
\]

The probability of zero accidents given that the student holds an eight-, ten-, and twelve-sided die will be calculated in the same way:
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\[
Pr(\text{Accidents} = 0|\text{Die} = 8) = \frac{5}{8} \times \frac{5}{8} \times \frac{5}{8} = .1526
\]

\[
Pr(\text{Accidents} = 0|\text{Die} = 10) = \frac{5}{10} \times \frac{5}{10} \times \frac{5}{10} = .0625
\]

\[
Pr(\text{Accidents} = 0|\text{Die} = 12) = \frac{5}{12} \times \frac{5}{12} \times \frac{5}{12} = .0301
\]

Then the overall probability that a student will experience zero accidents in one year is the sum of the product of the probabilities that there will be zero accidents for each individual die and the probability of that die.

\[
Pr(\text{Accidents} = 0) = Pr(\text{Accidents} = 0|\text{Die} = 6) \times Pr(\text{Die} = 6) + Pr(\text{Accidents} = 0|\text{Die} = 8) \times Pr(\text{Die} = 8) + Pr(\text{Accidents} = 0|\text{Die} = 10) \times Pr(\text{Die} = 10) + Pr(\text{Accidents} = 0|\text{Die} = 12) \times Pr(\text{Die} = 12)
\]

\[
Pr(\text{Accidents} = 0) = (.4823 \times .375) + (.1526 \times .125) + (.0625 \times .375) + (.0301 \times .125)
\]

\[
Pr(\text{Accidents} = 0) = .2271
\]

Finally, since the distribution of the dice is known, the probability that a student has a six-sided die is known to be .375.

\[
Pr(\text{Die} = 6) = .375
\]

Now that each piece of the equation has been calculated, the probability that the student has a six-sided die, given that he or she had zero accidents in the first year, can be found using Bayes’ Theorem:

\[
Pr(\text{Die} = 6|\text{Accidents} = 0) = \frac{Pr(\text{Accidents} = 0|\text{Die} = 6) \times Pr(\text{Die} = 6)}{Pr(\text{Accidents} = 0)}
\]

\[
Pr(\text{Die} = 6|\text{Accidents} = 0) = \frac{.4823 \times .375}{.2271} = .7962
\]

Given that a student has zero accidents, the probability that the student has each of the remaining die is calculated using the same methodology as above. Calculations can be seen in the simulation file.

\[
Pr(\text{Die} = 8|\text{Accidents} = 0) = \frac{.1523 \times .125}{.2271} = .0840
\]

\[
Pr(\text{Die} = 6|\text{Accidents} = 0) = \frac{.0625 \times .375}{.2271} = .1032
\]
\[
\Pr(Die = 6 | Accidents = 0) = \frac{.0301 \times .125}{.2271} = .0166
\]

Clearly, if a student had zero accidents in the first year of driving, the probability that he or she has a six-sided die is higher than originally expected when nothing was known about the student’s die. With the new probabilities for each die, I will re-calculate the expected number of accidents for each student in the coming year. The equation used to calculate the expected number of accidents is the same as before:

\[
\text{Exp(Accidents)} = \text{Exp(Accidents} | \text{Die} = 6) \times \Pr(\text{Die} = 6) + \text{Exp(Accidents} | \text{Die} = 8) \times \Pr(\text{Die} = 8) + \text{Exp(Accidents} | \text{Die} = 10) \times \Pr(\text{Die} = 10) + \text{Exp(Accidents} | \text{Die} = 12) \times \Pr(\text{Die} = 12)
\]

The expected number of accidents for each die does not change. However, because I now have one year of experience for each student, I know the different probabilities for each die. For a student with zero accidents in year one, the expected number of accidents in year two is:

\[
\text{Exp(Accidents)} = (.667 \times .7962) + (1.5 \times .0840) + (2 \times .1032) + (2.333 \times .0166) = .9019
\]

Assuming again that each accident will result in a claim of $1,000 to the insurance company, the expected cost of an insurance policy issued to an individual who had zero accidents in year one is $1,000 \times .9019 = $901.9. Rounding up to the nearest multiple of 50 again, the required premium to cover expected losses for a student with zero accidents in year one is $950. Calculations of expected losses and required premiums for a student with one, two, three, and four accidents—which are calculated using the same methodology as above for a student with zero accidents—can be found in the sheet labeled Bayes’ Theorem in the simulation file.

I have designed the Experience sheet in my Excel simulation file to calculate the required premium for year two using the formulas above and the number of accidents in year one. The premium calculated using their experience will be lower for students with fewer accidents and higher for students with more accidents. This is because students with less accidents in year one are more likely to have a six- or eight-sided die and thus have less expected accidents and less estimated cost to the insurance company. Students with more accidents in year one, on the other hand, are more likely to have dice with ten or twelve sides and are thus more dangerous drivers with higher expected costs to the insurance company. After giving the students their required premiums for year two, I will tell them they now have a choice to make: Insurance Company A, the company which used their experience to rate and price each student’s insurance individually, and Insurance Company B. Insurance Company B is a new company which was created to capture the disgruntled customers of Company A who are dissatisfied with the increase in their rates. Assuming a higher flat rate than Insurance Company A charged in year 1 will result in a better profit, Insurance Company B decides to charge a flat rate of $1,800. I chose this rate so that students with three or four accidents in year one, whose premiums with
Company A would be $2,000 and $2,100, respectively, would choose to switch to Company B. Students who had two accidents in year one, whose premiums with Company A are $1,800 will be indifferent. Finally, students with zero or one accidents in year one, whose premiums with Company A will be $950 and $1,350, respectively, will choose to stay with Company A.

After students have all chosen their insurance company for year two, they will "drive" for another year. Then, using both years of experience, I will calculate the probabilities that they are a dangerous driver, a poor driver, an average driver, and a good driver once again using both years of experience. Then I will re-price their insurance for year three based on what type of driver they are expected to be (which die they are expected to have), which will tell me how many accidents they are expected to have in year three and what is the expected cost to the insurance company. First, I will need to calculate the probability that the student holds each die. Again using Bayes’ Theorem, this time with both years of experience, I will show how to calculate the probability that the student holds a six-sided die given that he or she has experienced zero accidents in years one and two.

\[
\Pr(\text{Accidents} = 0|\text{Die} = 6) = \frac{\Pr(\text{Accidents} = 0|\text{Die} = 6) \times \Pr(\text{Die} = 6)}{\Pr(\text{Accidents} = 0)}
\]

The probability that a student has zero accidents in years one and two given that the student has a six-sided die can be calculated by multiplying the probability that a student with a six-sided does not roll a six or higher eight times.

\[
\Pr(\text{Accidents} = 0|\text{Die} = 6) = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6} = .2326
\]

Then the probability that a student has zero accidents given that the student holds an eight-, ten-, and twelve-sided die can be calculated in the same way:

\[
\Pr(\text{Accidents} = 0|\text{Die} = 8) = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8} = .0233
\]

\[
\Pr(\text{Accidents} = 0|\text{Die} = 10) = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10} = .0039
\]

\[
\Pr(\text{Accidents} = 0|\text{Die} = 12) = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{12 \times 12 \times 12 \times 12 \times 12 \times 12 \times 12 \times 12} = .0009
\]

As before, the overall probability that a student experiences zero accidents in years one and two can be calculated by multiplying the probability of zero accidents for each die in years one and two by the probability that the student holds that die and summing for all four types of dice:

\[
\Pr(\text{Accidents} = 0) = \Pr(\text{Accidents} = 0|\text{Die} = 6) \times \Pr(\text{Die} = 6) + \Pr(\text{Accidents} = 0|\text{Die} = 8) \times \Pr(\text{Die} = 8) + \Pr(\text{Accidents} = 0|\text{Die} = 10) \times \Pr(\text{Die} = 10) + \Pr(\text{Accidents} = 0|\text{Die} = 12) \times \Pr(\text{Die} = 12)
\]

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The distribution of dice remain the same, but the probability of zero accidents in years one and two is different than the probability of zero accidents in year one alone. For two years of experience:

\[
\Pr(Accidents = 0) = (.2326 \times .375) + (.0233 \times .125) + (.0039 \times .375) + (.0009 \times .125)
\]

\[
\Pr(Accidents = 0) = .0917
\]

Again, because the distribution of dice has remained the same, the probability that the student holds a six-sided die is the same as before:

\[
\Pr(Die = 6) = .375
\]

With all of the pieces of the equation calculated, the probability that the student holds a six-sided die given that he or she has experienced zero accidents can be calculated using Bayes' Theorem:

\[
\Pr(Die = 6|Accidents = 0) = \frac{\Pr(Accidents = 0|Die = 6) \times \Pr(Die = 6)}{\Pr(Accidents = 0)}
\]

\[
\Pr(Die = 6|Accidents = 0) = \frac{.2326 \times .375}{.0917} = .9511
\]

Using this same methodology, the probability that a student who has experienced zero accidents holds an eight-, ten-, and twelve-sided die can be calculated:

\[
\Pr(Die = 8|Accidents = 0) = \frac{.0232 \times .125}{.0917} = .0317
\]

\[
\Pr(Die = 10|Accidents = 0) = \frac{.0039 \times .375}{.0917} = .0160
\]

\[
\Pr(Die = 12|Accidents = 0) = \frac{.0009 \times .125}{.0917} = .0012
\]

Clearly, after two years of experience, if a student has had zero accidents, the probability that he or she holds a six-sided die is very high, and thus he or she is expected to be a good driver. I will calculate the expected number of accidents in year three by multiplying the expected number of accidents for each die by the probability that the student holds that die, given their experience in years one and two.

\[
Exp(Accidents) = \text{Exp}(Accidents|Die = 6) \times \Pr(Die = 6) + \text{Exp}(Accidents|Die = 8) \times \Pr(Die = 8) + \text{Exp}(Accidents|Die = 10) \times \Pr(Die = 10) + \text{Exp}(Accidents|Die = 12) \times \Pr(Die = 12)
\]
Then the expected number of accidents in year three for a student who had zero accidents in years one and two will be:

\[ \text{Exp}(\text{Accidents}) = (0.667 \times 0.9511) + (1.5 \times 0.0317) + (2 \times 0.0130) + (2.333 \times 0.0012) = 0.7165 \]

Assuming each accident results in a $1,000 claim to the insurance company, the expected cost of an insurance policy for a student who had zero accidents in years one and two is $0.7165 \times 1,000 = $716.5. Rounding up to the nearest multiple of 50, as before, the premium required in year three for an insured who experienced zero accidents in years one and two is $750. The required premiums for every possible combination of accidents in years one and two have been calculated in the sheet labeled Bayes' Theorem in the simulation file. Again, I have designed the sheet labeled Experience in the Excel file to automatically calculate the required premium for year three after I input the students' experience for years one and two.

After the first two years of driving, I will show the students the premiums they will be required to pay with Company A for year three. Company B, after an unsuccessful first year with the flat rate of $1,800 has decided to steal Company A's old rating plan, which only takes into consideration one year of experience. Under Company B, students are given the option to pay the same premium for year three that they would have paid under Company A for year two. Finally, Company C has been created and has decided to offer a flat premium higher than Company B’s to attempt to produce a profit. Company C will charge $2,000 for all insurance policies. Students are once again given the choice between Companies A, B, and C.

The best drivers who have experienced the fewest accidents will choose Company A, whose experience rating and pricing allow them to get the lowest premium. Drivers who can benefit from only using the first year of experience (for example, a driver who had zero accidents in year one but three accidents in year two) will choose Company B. The worst drivers who experienced the most accidents will choose Company C’s flat-rate policy which is priced lower than their experience-rated policies at both Companies A and B. Students will finally be asked to drive for one more year, and I will record their number of accidents in year three.

After I have recorded all of the students' accidents for all three years, I will explain to the students that insurance companies with the most accurate rating plans (in our experiment, Company A) tend to attract better, less-risky customers because they offer the lowest rates to the best drivers. Insurance companies which use out-of-date or less-accurate rating plans (Company B) will attract slightly worse customers because worse drivers who can benefit from a rating plan which doesn’t accurately measure their higher risk will be attracted to such companies. Finally, companies that offer a flat rate (Company C) will only attract the highest-risk, most dangerous customers because they are the only ones who will benefit from the flat-rate insurance. Better customers who can get a lower premium with another company will not buy insurance from a company offering a flat rate. Finally, I will show them that because companies with less-accurate or flat-rate plans attract more risky drivers, they not only have a more risky book of business, but they also have more costs to pay and thus less chance to make a profit. In the Profit-Loss sheet in my Excel simulation file, I have calculated the profit and loss for
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Companies A, B, and C using the data the students provided by rolling the die. If a student chose Company A for year two, for example, their premiums paid and loss from accidents were recorded on the sheet labeled Insurance Company A, and profit or loss that student provided for the company was calculated. Then the Profit-Loss sheet shows the total profit and/or loss for each company in all three years.

Conclusion:

After giving my presentation, I am very happy with the result. Students asked questions about the actuarial field throughout my PowerPoint presentation, and I think they all grasped Bayes’ Theorem. The simulation went smoothly, and the students seemed interested in the calculations behind it as well as the general concept of experience rating. In the end, about a third of the class requested brochures about Actuarial Science and more information about pursuing a career as an actuary. I definitely think I met my goal of generating interest in the field as well as fostering a general understanding of basic topics actuaries face on a daily basis. I hope the students who expressed interest in Actuarial Science will pursue a degree in the field and be as happy with their decision as I am!
What is an Actuary?

An Honors Thesis
Amy Parrish
What is the best job in America?

According to careercast.com, a site which annually ranks jobs in the United States: ¹

<table>
<thead>
<tr>
<th>Year</th>
<th>Mathematician</th>
<th>Actuary</th>
<th>Software Engineer</th>
<th>Statistician</th>
<th>Computer Systems Analyst</th>
</tr>
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</table>

According to the Jobs Rated Almanac: ²

<table>
<thead>
<tr>
<th>Edition</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Edition (1988)</td>
<td>1</td>
</tr>
<tr>
<td>2nd Edition (1992)</td>
<td>1</td>
</tr>
<tr>
<td>3rd Edition (1995)</td>
<td>1</td>
</tr>
<tr>
<td>4th Edition (1999)</td>
<td>1</td>
</tr>
</tbody>
</table>

Careercast ratings are based on stress level, physical demands, hiring outlook, compensation and work environment. ¹


² Jobs Rated Almanac ratings taken from the following website: [http://beanactuary.com/about/best_job.cfm](http://beanactuary.com/about/best_job.cfm)
What is an Actuary?

Actuaries analyze historical data in order to:

- Evaluate the likelihood of future events
- Reduce the likelihood of undesirable events, when possible
- Decrease the negative impact of undesirable events that do occur

Examples of Undesirable Events:
- House damage from hurricane
- Car accident
- Premature death of a family member
- Insufficient retirement funds

Ways to Decrease and Manage the Risk:
- Hurricane-specific construction in hurricane areas; homeowners insurance policy
- Safe driving; car insurance policy
- Healthy living; life insurance policy
- In-depth retirement planning; annuities

This information, and additional information about the actuarial career can be found at:
http://beanaactuary.org/about/

Speaking notes:
- Undesirable events are risks. One example of such a risk is the loss of your home due to a hurricane.
- Actuaries have models to evaluate the risk of such an event.
- Although actuaries cannot prevent hurricanes, to prevent loss of home due to a hurricane, one could refuse to build in a hurricane-prone area, which actuaries try to encourage by charging high premiums in such areas. Hurricane-specific construction is also encouraged and sometimes required for insurance. Premium discounts provide incentives for builders to invest in safer construction in such areas.
- Finally, in the event that a loss does occur, actuaries aim to decrease the negative impact of the loss through insurance. If a home is completely damaged due to a storm, instead of having to replace the home and the entire value of its contents, the insurance company will cover the loss above the deductible.
- Similarly, actuaries use historical data to evaluate the probability of other undesirable events such as a car accident of the premature death of a family member. Safe driving and healthy living, which are often encouraged through lower premiums for the insured, can prevent or prolong such events. However, if such an event does occur, the insurance policies created by actuaries are meant to decrease the negative financial impact.
- Insufficient retirement funds is a risk that has been realized often in recent years. To prevent this issue, careful retirement planning can be used, and actuaries can price financial instruments such as annuities to allow retirees to receive lifelong benefits.
Compen$ation and Hiring Outlook

Actuaries are paid well for what they do. According to DW Simpson Global Actuarial Recruitment, the average starting wage for an actuary is between $46,000 and $65,000.

Examples of exam and experience salary incentives can be found here.⁴

The actuarial field is challenging and provides constant opportunities for advancement; most companies offer a salary increase with each successive exam passed.

According to the Bureau of Labor Statistics, employment of actuaries is expected to grow much faster than the average for all occupations at about 21% over the 2008-2018 period.⁵

⁴http://dwsimpson.com/salary.html
⁵http://www.bls.gov/oco/ocos041.htm#outlook

Note: the national average for all occupations is between 7 and 13%.
Work Environment

Actuaries work desk jobs with little physical demands.

The average work week for an actuary is about 40 hours, though some consulting jobs may require more.

Advancement is always possible and often encouraged.

Actuaries with experience and broad knowledge base can advance to be Chief Risk Officers or even Chief Financial Officers of their companies.

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⁶The information on this slide is taken from the Bureau of Labor Statistics' website at http://www.bls.gov/oco/ocos041.htm#nature
Works Cited


