

Chapter 16 and 17: RV's and Prob. Dist.

1. An insurance policy costs \$100 and will pay policyholders \$10,000 if they suffer a major injury (resulting in hospitalization) or \$3000 if they suffer a minor injury (resulting in lost time from work). The company estimates that each year, 1 in every 2000 policyholders will have a major injury, and 1 in 500 a minor injury.
- a) Fill in the possible profits for the company?

Type of Accident	(major)	(minor)	(none)
X = Amount of Profit	-9900	-2900	+100

- b) Create a probability model for the profit on a policy by adding $P(X = x)$ to the table you started in (a).
Let x be the profit.

	(major)	(minor)	(none)
x	-9900	-2900	+100
$P(X=x)$	0.0005	0.002	0.9975

- c) What's the company's expected profit on this policy? (Provide an estimate by sampling)
Note: Your answers will be different, but they should be close.
(approximate) expected profit = 89.5

- d) What's the standard deviation? (Provide an estimate by sampling)
(approximate) SD = 254.93

2. Bernoulli Trials.

- a) What are the requirements for Bernoulli trials?

Success/Failure outcomes

Probability of success is fixed for each trial

Independent trials

3. Binomial Model.

- a) What are the requirements to apply the Binomial model?

The trials are a fixed number of Bernoulli trials. And we are interested in counting the number of successes.

- b) What is the formula for the mean of the Binomial model?

np

- c) What is the formula for the SD of a Binomial model?

\sqrt{npq}

4. The American Red Cross says that about 11% of the U.S. population has Type B blood. A blood drive is being held at COC.

- a) What is the probability that exactly 2 of the first 20 blood donors have Type B blood? What model is best to use?

The Binomial Model applies. $n = 20$, $p = 0.11$. Binomial(20, 0.11)

Probability ANSWER: 0.282

- b) What is the probability that less than 4 of the first 20 blood donors have Type B blood?

0.829

- c) What is the probability that at least 1 of the first 20 blood donors have Type B blood?

0.903

- d) The blood drive has a total of 150 donors. Assuming this is a typical number of donors for a COC blood drive, what would be the mean and standard deviation of the number of donors who have Type B blood?

Mean = $np = (150)(0.11) = 16.5$

Standard Deviation = $\sqrt{npq} = 3.832$

- e) Under the setting of part (d), does the normal approximation apply?

Yes. $np = (150)(0.11) = 16.5 > 10$ (similarly for nq)

- f) Surprised by the low number of Type B blood donors at the blood drive, the American Red Cross wonders if the 11% estimate was too high for this area. How many Type B blood donors would it take to convince you that this estimate might be too high? Justify your answer.
- Since the normal model applies, anything below 3 standard deviations away from the mean would be VERY unusual. Therefore, anything lower than $16.5 - 3(3.832) = 5$ would be unusual. Therefore, if there were 5 or fewer people, I would be suspicious of the original 11% estimate.

(Note: If you calculated the answer for 2 standard deviations, that's fine too!)