Case Study:

Shortly after daybreak on April 3, 1974, thunder rumbled through the dark skies that covered much of the midwestern United States. Lightning struck areas from the Gulf Coast states to the Canadian border. By the predawn hours of the next day, the affected region of around 490,000 acres was devastated by more than 100 tornadoes. This “super outbreak” was responsible for the deaths of more than 300 people in 11 states. More than 6100 people were injured by the storms, with approximately 27,500 families suffering some kind of loss. The total cost attributed to the disaster was more than $600 million. Amazingly, the storm resulted in six category five tornadoes with wind speeds exceeding 260 miles per hour. To put this figure in perspective, the region endured about one decade's worth of category five tornadoes in a single 24-hour period!

Fujita Wind Damage Scale		
F-scale	**Wind Speed (mph)**	**Damage**
F-0	Up to 72	Light
F-1	73 to 112	Moderate
F-2	113 to 157	Considerable
F-3	158 to 206	Severe
F-4	207 to 260	Devastating
F-5	Above 260	Incredible

Structural engineers and meteorologists are interested in understanding catastrophic events such as this tornado outbreak.

Variables such as tornado intensity (as described by the F-scale), tornado duration (time spent by the tornado in contact with the ground), and death demographics can provide insights into these events and their impact on the human population. The following table lists the duration time and F-scale for each tornado in the April 1974 super outbreak.

Tornado Duration Times	
F-scale	**Tornado Duration (minutes)**
F-0	1, 1, 5, 1, 1, 6, 4, 10, 5, 4, 1, 1, 1, 1, 1, 1, 1, 1, 1, 30, 1, 9
F-1	16, 13, 9, 8, 13, 10, 15, 1, 17, 23, 10, 8, 12, 5, 20, 31, 12, 5, 30, 13, 7, 1, 5, 13, 1, 2, 5, 10, 1, 20, 5
F-2	7, 15, 2, 10, 23, 10, 7, 12, 8, 1, 8, 19, 5, 10, 15, 20, 10, 13, 20, 15, 13, 14, 1, 4, 2, 15, 30, 91, 11, 5
F-3	9, 20, 8, 16, 26, 36, 10, 20, 50, 17, 26, 31, 21, 30, 23, 28, 23, 18, 35, 35, 15, 25, 30, 15, 22, 18, 58, 19, 23, 31, 13, 26, 40, 14, 11
F-4	120, 23, 23, 42, 47, 25, 22, 22, 34, 50, 38, 28, 39, 29, 28, 25, 34, 16, 40, 55, 124, 30, 30, 31
F-5	37, 69, 23, 52, 61, 122

The following table presents the number of deaths as a function of F-scale and community size:

Deaths as a Function of F-scale and Community Size			
F-Scale	**Deaths**	**Community Size**	**Deaths**
F-0	0	Rural areas	99
F-1	0	Small communities	77
F-2	14	Small cities	63
F-3	32	Medium cities	56
F-4	129	Large cities	10
F-5	130		

Create a report that graphically displays and discusses the tornado-related data. Your report should include the following:

1. A bar graph or pie chart (or both) that depicts the number of tornadoes by F-scale. Generally, only a little more than 1% of all tornadoes exceed F-3 on the Fujita Wind Damage Scale. How does the frequency of the most severe tornadoes of the April 3–4, 1974, outbreak compare with normal tornado formation?

2. A histogram that displays the distribution of tornado duration for all the tornadoes.

3. Six histograms displaying tornado duration for each of the F-scale categories. Does there appear to be a relationship between duration and intensity? If so, describe this relationship.

4. A bar chart that shows the relationship between the number of deaths and tornado intensity. Ordinarily, the most severe tornadoes (F-4 and F-5) account for more than 70% of deaths. Is the death distribution of this outbreak consistent with this observation?

5. A bar chart that shows the relationship between the number of deaths and community size. Are tornadoes more likely to strike rural areas? Include a discussion describing the number of deaths as a function of community size.

6. A general summary of your findings and conclusions.

Data Source: Abbey, Robert F., and T. Theodore Fujita. “Tornadoes: The Tornado Outbreak of 3–4 April 1974.” In *The Thunderstorm in Human Affairs*, 2nd ed., edited by Edwin Kessler, 37–66. Norman, OK: University of Oklahoma Press, 1983. The death figures presented in this case study are based on approximations made from charts by Abbey and Fujita. Additional descriptions of events and normal tornado statistics are derived from Jack Williams's *The Weather Book* (New York: Vintage Books, 1992).