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DLE 2083: INTRODUCTION TO SECURITY MANAGEMENT

CHAPTER 6

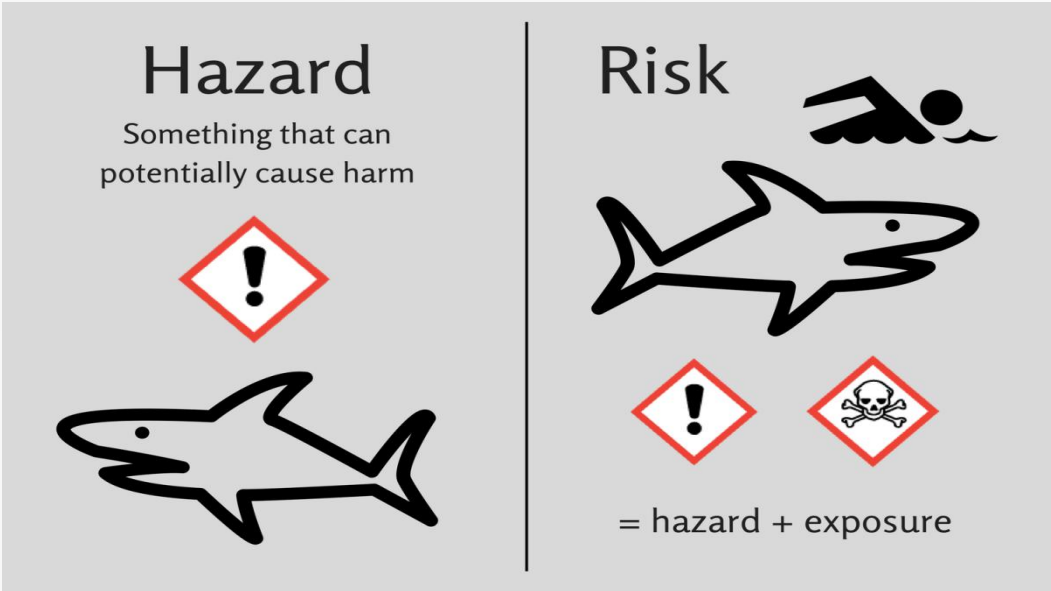
PROBABILITY AND UNCERTAINTY

Chapter 6: Learning Outcomes

- At the end of the topic, students should be able to:
  - Defines uncertainty and probability.
  - Explain the relationship between uncertainty and probability.
  - Describes the comparison between the uncertainty and probability.
  - Explain the combination of uncertainty and probability in security risk assessment.

Introduction

- The concepts of risk and hazard inherently include the concept of uncertainty.
- Risk is **potential** returns, and a hazard is a **potential** threat.
- This **potential** is a type of **uncertainty**.



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Defining Uncertainty

- Uncertainty is **the lack of knowledge, information or uderstanding about the outcome or impact of an event**.
- Due to unknown variables or limited data
- Refers to degree of ignorance and ambiguity

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Examples of Uncertainty

- Not knowing whether a particular vulnerability exists in a system.
- Ambiguity about an attacker's intentions or capabilities.

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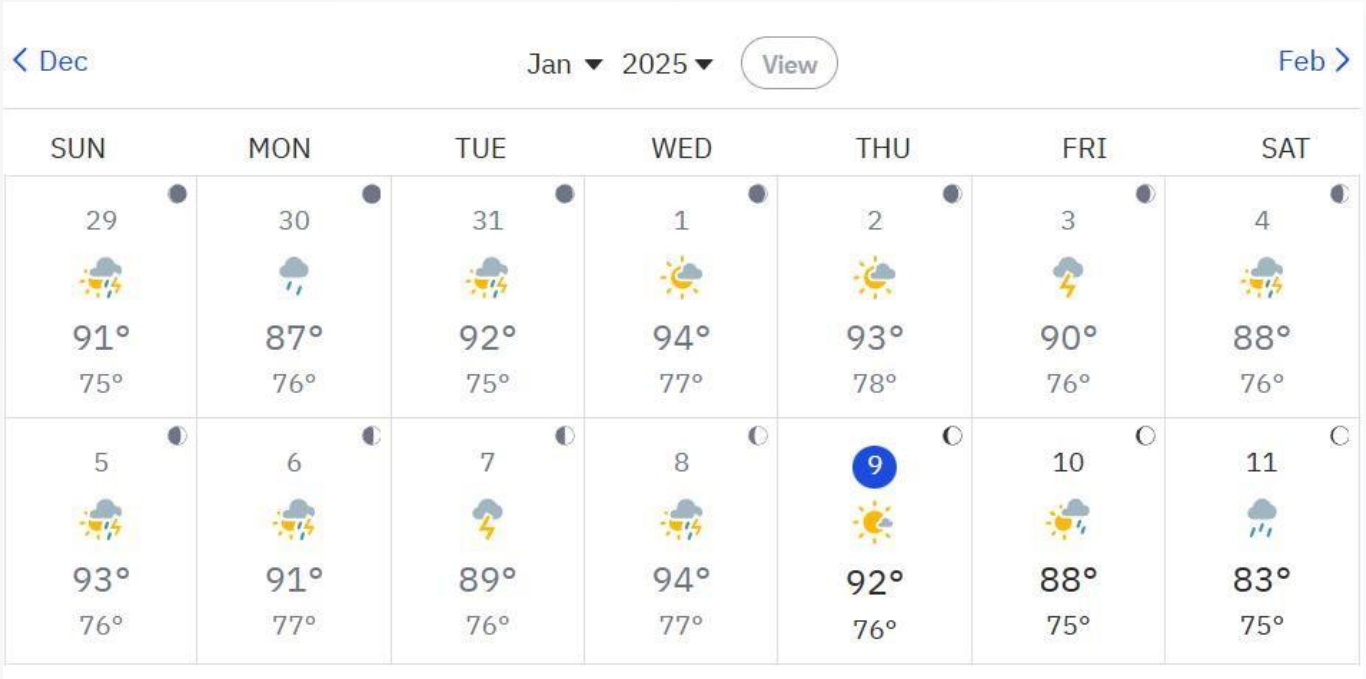
Defining Probability

- Probability, likelihood, and chance each mean the extent to which something could occur.
- Probability implies quantitative expressions (using numbers)
- Quantitatively, probability can be expressed as a number from 0 to 1 or a percentage from 0% to 100%.
- Relies on data and model

Examples of Probability

- **Assessing the likelihood of a ransomware attack affecting a system (e.g., "There is a 30% chance this year").**
- **Lets do an activity:**



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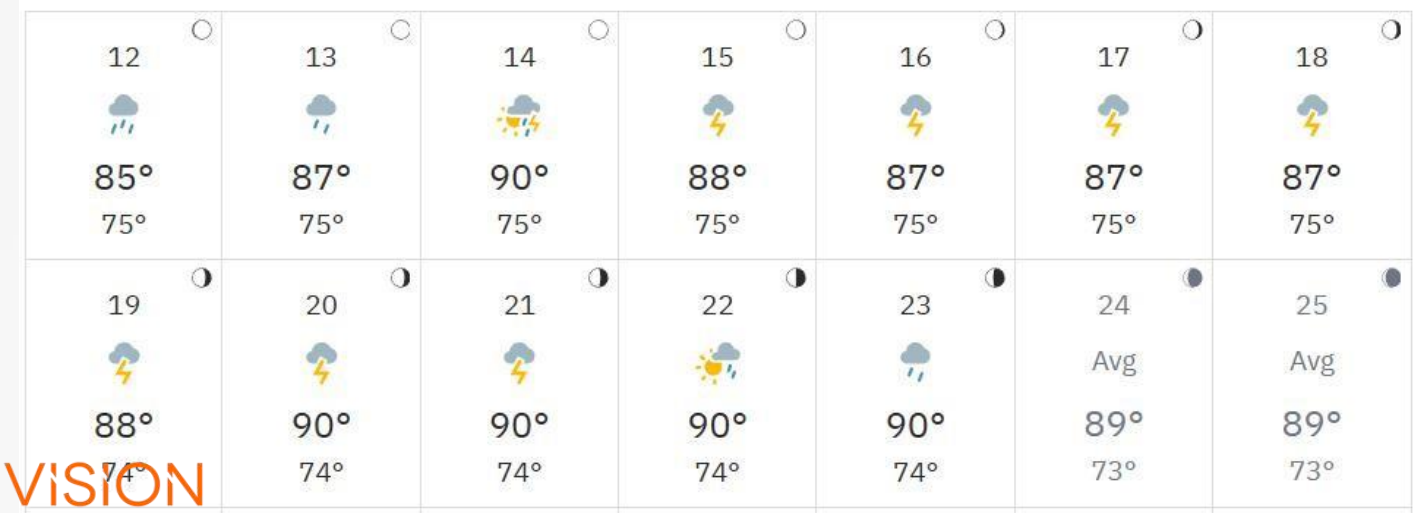
Examples of Probability

- **What is probability for**
- **Hot weather?**
- **Rainy weather?**
- **Cloudy weather?**
- **Precipitation-based weather?**
- **Extreme weather?**



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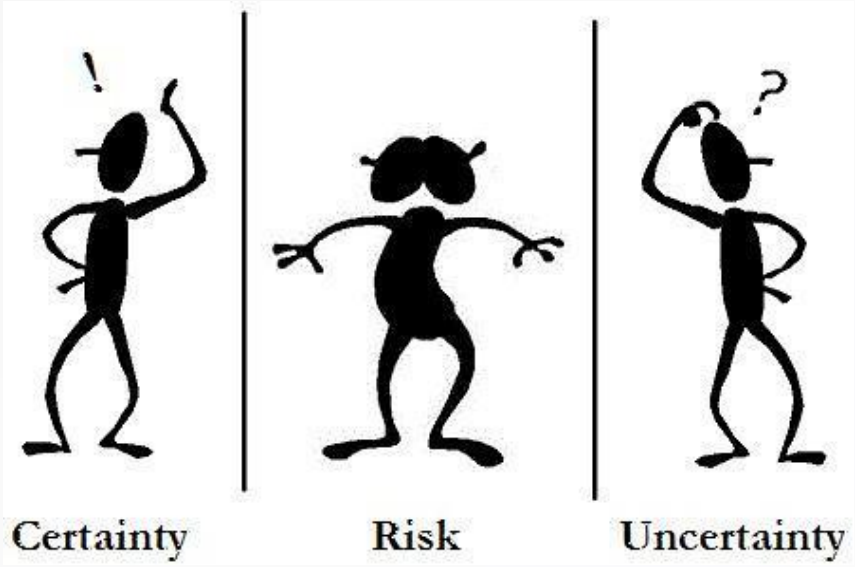
The Relationship Between Uncertainty and Probability

- Uncertainty often affects probability calculations.
- For example: If there's high uncertainty about a system's vulnerabilities, estimating the probability of a successful attack becomes less reliable.

The Relationship Between Uncertainty and Probability

- Uncertainty implies no assessed probability, so an uncertain event implies a range of probabilities from 0% to 100%.
- Certainty, like definitely, implies a probability of 100%.



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The Difference Between Uncertainty and Probability

Aspect	Uncertainty	Probability
Focus	Lack of knowledge or ambiguity	Likelihood of a specific event occurring
Nature	Subjective, qualitative, or semi-quantitative	Objective, quantitative
Measurement	Difficult to quantify; ranges or categories	Numerical (0–1 or percentage)
Role in Security	Highlights gaps in information or clarity	Guides risk assessment and prioritization
Dependency	May decrease as knowledge improves	Requires sufficient data to calculate

Role of Probability in Security Management

- Helps quantify risk
- Supports prioritization of risk and threats
- Used in threat modeling, incident prediction, and response planning

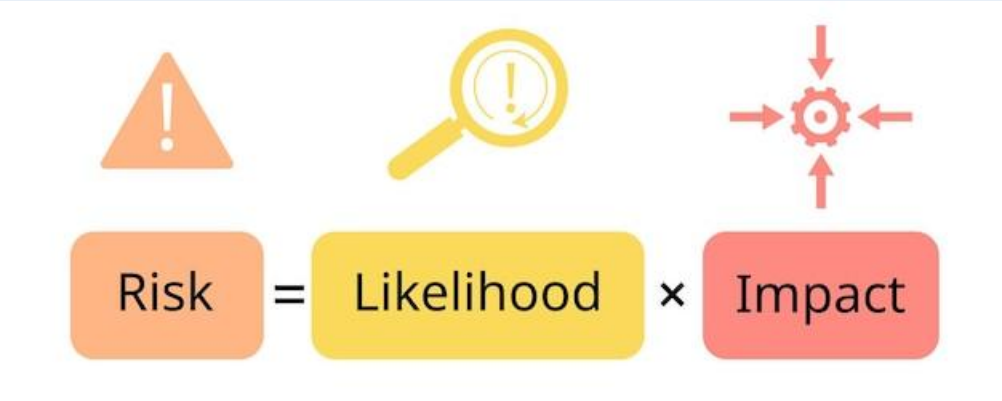
Combination of probability and uncertainty in security risk assessment

5x5 Risk Matrix Example

Impact
How severe would the outcomes be if the risk occurred?

Probability
What is the probability the risk will happen?

	Insignificant 1	Minor 2	Significant 3	Major 4	Severe 5
5 Almost Certain	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
4 Likely	Medium 4	Medium 8	High 12	Very high 16	Extreme 20
3 Moderate	Low 3	Medium 6	Medium 9	High 12	Very high 15
2 Unlikely	Very low 2	Low 4	Medium 6	Medium 8	High 10
1 Rare	Very low 1	Very low 2	Low 3	Medium 4	Medium 5



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Combination of probability and uncertainty in security risk assessment

Risk	Probability	Impact	P x I
Training gap	0.1	0.7	**0.07**
Missing the coding milestone due to scope change	0.5	0.5	**0.25**
Extending test coverage due to quality issues requiring more resources	0.3	0.9	**0.27**
Schedule impact due to year end holidays	0.3	0.5	**0.15**
Procurement delays	0.5	0.7	**0.35**

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How to reduce uncertainty?

- Improve data collection (CCTV recording video, access logs, emails, website)
- Use historical trends and reports
- Engage in scenario-based planning
- Conduct frequent threat and vulnerability assessments

Exercise - Discussion

1) What uncertainties can be found in the warehouse?

2) How can probability help you to install security equipment in warehouse?

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Thank you

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