Summary (Unit 3)

> **Video**
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> **Video:** Live Examples – Calcium Oxalate Crystals (40:18 Total)

> **Video**
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> **Video:** Live Examples – Diabetes (10:33 Total)

This summary provides a quick recap of the material you've learned in the probability unit so far. Please note that this summary does not provide complete coverage of the material, but just lists the main points. We therefore recommend that you use this summary only as a checklist or a review before going on to the next unit, or before an exam.

General Remarks

- Probability is a discipline by itself. In the context of the big picture of this course, probability is used to quantify the imperfection associated with drawing conclusions about the entire population based only on a random sample drawn from it.
- The probability of an event can be as low as 0 (when the event is impossible) and as high as 1 (when the event is certain).
- In some cases, the only way to find the probability of an event of interest is by repeating the random experiment many times and using the relative frequency approach.
- When all the possible outcomes of a random experiment are equally likely, the probability of an event is the fraction of outcomes which satisfy it.
- There are many applications of probability in the health sciences including sensitivity, specificity, predictive value positive, predictive value negative, relative risk, odds ratios, to name a few.

Probability Principles

Probability principles help us find the probability of events of certain types:

- **The Complement Rule**, P(not A) = 1 – P(A), is especially useful for finding events of the type "at least one of …"
- To find the probability of **events of the type "A or B"** (interpreted as A occurs or B occurs or both), we use the General Addition Rule: P(A or B) = P(A) + P(B) – P(A and B).In the special case when A and B are disjoint (cannot happen together; P(A and B) = 0) the Addition Rule reduces to: P(A or B) = P(A) + P(B).
- To find the probability of **events of the type "A and B"** (interpreted as both A and B occur), we use the General Multiplication Rule: P(A and B) = P(A) * P(B | A). In the special case when A and B are independent (the occurrence of one event has no effect on the probability of the other occurring; P(B | A) = P(B)) the Multiplication Rule **reduces** to: P(A and B) = P(A) * P(B).
- Both **restricted versions** of the addition rule (for disjoint events) and the multiplication rule (for independent events) **can be extended** to more than two events.
- P(B | A), the **conditional probability** of event B occurring given that event A has occurred, can be viewed as a reduction of the sample space S to event A. The conditional probability, then, is the fraction of event A where B occurs as well, P(B | A) = P(A and B) / P(A).
- Be sure to follow reasonable rounding rules for probability, including enough significant digits and avoiding any rounding in intermediate steps.

> **(Optional) Outside Reading:** Little Handbook – Probability (≈ 1000 words)