AP Statistics – Unit 3 Quick Notes

1. Study Types

Observational: No treatment imposed, shows association only. *Ex: survey on sleep & GPA.*
Experiment: Treatments imposed, can show causation. *Ex: assign study sessions & measure test scores.*

Prospective: Follow subjects forward in time. **Retrospective:** Use past data/records.

Variables: → **Explanatory** (factor) influences **Response** (outcome). → **Confounding:** Related to both variables, distorts results. → **Lurking:** Unmeasured but affects both.

2. Sampling Methods

Goal: Representative sample for valid inferences.

SRS: Label all, use random method, choose matching individuals. **Stratified:** Split into strata (homogeneous groups), SRS in each. Improves precision. **Cluster:** Split into clusters (natural groups), randomly pick clusters, sample all in chosen clusters.

3. Sampling Bias

Undercoverage: Missing population groups (e.g., landlines only). **Voluntary Response:** Strong opinions overrepresented. **Convenience:** Easy-to-reach only. **Question Wording:** Leading/unclear phrasing. **Response Bias:** Inaccurate answers due to wording/interviewer/memory. **Nonresponse:** Selected individuals don't respond.

4. Bias & Variability

Bias: Systematic over/underestimate. **Variability:** Spread of estimates. **Unbiased estimator:** $E[\hat{\theta}] = \theta$, e.g. $\bar{x} \to \mu,\ \hat{p} \to p$.

5. Experimental Design

Principles: Control, Random Assignment, Replication. **Factors:** Variables manipulated. **Levels:** Values of factors. **Treatments:** Combos of levels.

Design Types: • **CRD:** Assign all units to treatments at random. • **RBD:** Block by characteristic, randomize within blocks. • **Matched-Pairs:** Pair similar units; assign treatments within pairs (can be same subject pre/post).

Blinding: • **Single:** Subject or evaluator unaware. • **Double:** Both unaware. • **Placebo Effect:** Response to inert treatment.

6. Inference Rules

Random Sampling
Inference to population
No RS → can't generalize

Random Assignment
Inference for causation
No RA → can't conclude causation

7. AP Tips

- Always state population & sampling frame.
- Detail random selection/assignment method.
- Address possible biases.
- For experiments: specify treatments, controls, blinding.