OFFICIAL MIDTERM 1 SYLLABUS

UNKNOWN AUTHOR (EDITED BY COLTON GRAINGER)

Here's an "official" midterm syllabus that I dug up from Canvas. We covered this and different content in class, and used more sophisticated terminology.

To critique the following syllabus, start noticing::

- *they're only sketchs of recipes for performing "pseudo-mathematics"*,
- *they're dated by the job market*
- *they're constrained by calculator computation*,

However, I want all y'all to suceed in the midterm. Let's have a "cautious" look at the material together.

1. Content on Midterm 1

1. Sampling Techniques
   - Stratified
   - Clustered
   - Simple random sample (SRS)
   - Systematic
2. Classifying Variables
   - Quantitative
   - Qualitative
3. Levels of Measurement
   - Nominal
   - Ordinal
   - Interval
   - Ratio
4. Statistics vs. Parameters
   - Samples vs. statistics
   - Populations vs. parameters
5. Experiments vs. Observational studies
   - Control vs. treatment groups
   - Variable = what we are measuring
   - Placebo

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6. Histograms
   - Quantitative
   - Class width
     - Max – Min divided by number classes (round up to nearest whole number)
     - Midpoint = middle of class
   - Class boundaries
     - Subtract 0.5 from lower limit
     - Add 0.5 to upper limit
7. Other graphs/charts
   - Ogive vs. time series
   - Circle graph
     - Mutually exclusive portions of the pie ONLY
   - Bar graph vs. pareto
   - Stem & leaf
   - Box & whisker
8. Shapes of distributions
   - Mound/symmetric
   - Skewed
   - Uniform
   - Bimodal
9. Frequency tables
   - L1 = data points
   - L2 = frequency of each data point
10. 5% trimmed mean
    - Determine n (number of data points)
    - N * 0.05 (yields number to trim off of top and bottom)
    - Re-compute mean using 1-var stats
11. Weighted averages
12. Basic Stats
    - Mean
    - Median
    - Quartiles (Q1, Q3, IQR)
    - Min/Max
    - Mode
13. Coefficient of variation
    - take σ / μ, then convert to percentage
    - What % of the mean is the standard deviation?
14. Chebyshev's Theorem
    - $1 - 1/(k^2)$ gives the proportion of data that lies within a radius of k standard deviations from the mean
    - therefore, at least 75% lies within 2 standard deviations

15. Probability
    - Mutually exclusive events vs. independent events
        - mutually exclusive events are represented by disjoint sets
        - Independent = one thing doesn't affect probability of another thing
    - With vs. without replacement & how that affects 2-component probability problems
    - Sample space $\Omega = \{x, y, z\}$
    - $P(A)$ vs. $P(A)^c$
    - if $E_1, E_2, \ldots$ are disjoint events, and their union is the entire sample space Ω, then $\mathbf{P}(E_1) + \mathbf{P}(E_2) + \cdots) = \mathbf{P}(E_1 \sqcup E_2 \sqcup \ldots) = \mathbf{P}(\Omega) = 1$.
    - Common examples:
        - 6 sided die
        - 52 card deck
        - roulette
    - "Given" probabilities & contingency tables
    - $P(A \text{ or } B) = P(A \cup B)$ vs. $P(A\&B) = P(A \cap B)$
    - Continuous vs. discrete random variables
    - Probability distribution tables
        - Calculate average or expected value and variance based on probability distribution
16. Odds
    - the "odds for an event" is the ratio of the number ways $P(E)$ to get the event E you want against the number of ways $P(E^c)$ to not get what you want E^c
    - the "odds against an event" is the reverse ratio
        - these are also called "betting odds"
    - What's the relation to of betting odds to probability?
17. Binomials
    - using the TI-84 with the (n, p, k) notation
        - n trials
        - p probability of success
        - r observed sucesses
    - `binompdf` gives the PMF (or the exact number of outcomes)
    - `binomcdf` gives the CMF (or the cumulative number of outcomes up to a specified number of observed successes)
        - the calculator counts from 0 to number you put in for k
        - Use `binomcdf` for following scenarios:
            - "at most k"
            - "k or less"
            - "fewer than k"
        - Use 1^{-}`binomcdf` for the following scenarios:
            - "at least k"
            - "k or more"
            - "greater than k"
    - Rules for using binomials
        - the trials are independent
        - each trial has only 2 outcomes (success or failure)
        - the probability of success for each trial is constant

18. Normal Distributions
    - Normal vs. Standard Normal
    - Symmetrical properties
    - Empirical rule
        - 68% within 1σ, 95% within 2σ, 99.7% within 3σ of μ
    - Z-scores (Negative vs. positive z-scores and how they relate to μ)
        - $Z = x - \mu$
    - Find the cumulative probability given a Z-score or x-value (`normalcdf`)
    - Find the Z-score given a cumulative probability (`invNorm`)
19. Control Signals
    - 9 consecutive values are above mean or 9 consecutive values are below mean
    - Any value is outside 3σ
    - 2 of 3 consecutive values have absolute value greater between 2σ and 3σ
20. Central Limit Theorem
    - As the number of samples n increases, the mean of the various samples $\bar{x}$ approaches the normal distribution
    - one needs $n \geq 30$ if one doesn't know that the original distribution is normal

2. Calculator Functions

Be comfortable with:

1. `INPUTTING DATA INTO LISTS (L1, L2)`
2. `1-VAR STATS`
3. `BINOMPDF`
4. `BINOMCDF`
5. `TABLE FUNCTION TO FIND N FOR BINOMIALS`
6. `NORMALCDF`
7. `INVNORM`