# PSCI 2300 • Intro to Poli Sci Research Methods (Spring 2018)
## Dr. Paul Hensel
## Review Sheet for Exam #2

### Exam Format

• This examination will feature 20-30 multiple choice questions (worth 1 point each) and 5-10 short answer questions (worth 2 points each). No calculators will be needed; the short answer questions will require you to define relevant terms, interpret results that are provided for you, or apply statistical tables (which will be provided for you) to answer questions.
• All needed exam materials (such as Scantron sheets) will be provided for you, except for your preferred pencil. No books, notes, or other materials will be allowed during the exam; copies of the relevant formulas and tables will be included with the exam.
• Note that no bathroom breaks are permitted during the exam -- once you leave the room, you can't return without a five letter grade penalty.
• Also, be on time -- once the first person finishes and leaves the room, anybody else who enters will suffer an automatic deduction of five letter grades; be aware that students sometimes finish exams like this in as little as 5-10 minutes.

### Advice on Studying

• The number of questions on each topic in the exam will (approximately) reflect the relative time spent on each topic in the course. A topic that was covered over two lectures should thus have approximately (but perhaps not exactly) twice as many exam questions as a topic that only lasted for one lecture.
• The exam will draw from both the assigned readings (including both textbook and workbook) and the lecture notes. Around 1/3 of the exam questions will be drawn from materials in the readings that were not covered at all in lecture, with the rest reflecting topics that were only covered in lecture or were covered in both lecture and the readings. If you missed one or more days of class, be sure to get a copy of those notes from somebody who was there.
--Note that in the past, questions drawn from the readings (even on concepts or topics specifically listed on the review sheet) have produced the lowest scores of any questions on the test, so you should take special care to study these topics on the review sheet.
• The exam will not be written with the intention of fooling students with trick questions or with the goal of failing as many students as possible. The main goal of this course is to provide students with an understanding of how Political Science research works, so the exam questions will reflect this goal.
• The list of topics on this review sheet is not legally binding; these are just suggestions for the most important topics that are most likely to be on the test (some of which may not actually appear on the test). If you understand all of these topics you are much more likely to do well on the test.

# Topics Covered in This Portion of the Course

## Descriptive Statistics

Topics Covered in Lecture

- Descriptive vs. inferential stats
- Type of descriptive stats: Frequency, central tendency, dispersion
- Descriptive stats for nominal-level variables: meaning, interpretation, when to use
    - --Frequency distribution
    - --Bar graphs
    - --Relative frequency (proportion, percentage): meaning and interpretation
    - --Ratio: meaning and interpretation
    - --Pie chart: meaning and interpretation
    - --Mode: meaning and interpretation
    - --Dispersion (eyeball/inter-ocular trauma): meaning and interpretation
- Descriptive stats for ordinal-level variables: meaning, interpretation, when to use
    - --(relevant stats discussed under nominal-level variables)
    - --Cumulative frequency
    - --Median
- Descriptive stats for interval-/ratio-level variables: meaning, interpretation, when to use
    - --(relevant stats discussed under nominal-/ordinal-level variables)
    - --Histogram
    - --Line graph
    - --Mean (including impact of skewness)
    - --Range
    - --Interquartile range
    - --Standard deviation

Additional Topics from the Readings (Pollock chapter 2 "Describing Variables" and Summary sections, Pollock chapter 6 "Variation Revisited: The Standard Deviation" section)

- *More details on topics covered in lecture*
- Meaning of central tendency and dispersion
- Bimodal distribution

## Sampling and Inferential Statistics

Topics Covered in Lecture

- Populations (and pop. parameters) vs. samples (and sample statistics), and purpose of sampling
- Goal of random sampling
- Systematic errors in sampling: selection bias, response bias, poorly written Qs, social desirability
- Random sampling error: meaning, intuition (variation component / sample size component)
- Normal distribution/normal curve: shape, mean=mode=median, symmetric/no skew, unimodal
- Probability density function and normal distribution (% cases within 1-2-3 SDs)
- Z-score: meaning, calculation
- Use of standard normal distribution with Z-scores (Table 6-3 in book)
- Central Limit Theorem and sampling distribution
- Pop. parameters: mean=$\mu$, standard deviation=$\sigma$
- Sample statistics: mean=$\bar{x}$, standard deviation=s
- Meaning of $\alpha$
- 95% confidence interval for mean: meaning, calculation (sample mean +/- 2 standard units)
- Student's t vs. Z: when each should be used
- Use of t distribution (Table 6-4 in book)
- 95% confidence interval for proportion: meaning, calculation

Additional Topics from the Readings (Pollock chapter 6)
• *More details on topics covered in lecture*

**Hypothesis Testing**
Topics Covered in Lecture
• Research hypotheses, null hypotheses, and testing
• Statistical significance: definition, role in hypothesis testing
• Limitations of statistical significance: can be inflated as N increases, difference from substantive significance, covariation vs. causation
• Type 1 and Type II errors
• p-values: definition, calculation using Z table/normal distribution and t distribution, role in hypothesis testing
• Direction vs. non-directional hypotheses, 1-tailed vs. 2-tailed tests
• General procedure for difference of means tests (t-tests)
• Critical values: definition, role in hypothesis testing
• Difference of means tests using 95% confidence intervals

Additional Topics from the Readings (Pollock chapter 7 Intro, "Statistical Significance", and "Comparing Two Sample Means" sections)
• *More details on topics covered in lecture*
• Error bar charts
• Eyeball test of statistical significance

# Formula Sheet for Exam #2
**[this formula sheet and these statistical tables will be included with the exam]**

## Descriptive Statistics

• Proportion = **f / N** *(where f=frequency of cases in this category, and N=total sample size)*

• Percentage (%) = **(f/N)*100**

• Ratio = **f1 / f2** *(where f1 and f2 are the frequency of cases in each category)*

• Mean: $\bar{x} = \frac{\Sigma x_i}{N}$ *(where $x_i$ = the individual observation, N=sample size)*

• Calculating standard deviation:

Deviation = $X_i - \overline{X}$

Total Sum of Squares/TSS (Sum of Squared Deviations/SSD) = $\sum(X_i - \overline{X})^2$

Variance: $\sigma^2$ = TSS/N = $\frac{\sum(X_i - \overline{X})^2}{N}$

Standard deviation: $\sigma = \sqrt{\sigma^2}$

## Sampling and Inference

• Z score: $Z = \frac{x_i - \bar{x}}{s}$ *(where $x_i$=score for this observation, $\bar{x}$= mean for sample, s= std dev for sample)*

• Std error of sample mean = random sampling error = $\frac{\sigma}{\sqrt{n}}$ *(where σ=std dev of pop, n=sample size)*

--when σ not known, estimated by $\frac{s}{\sqrt{n}}$ *(where s=std dev of sample)*

• 95% Confidence interval for mean = $\bar{x}$ **+/- 2 S.E.** *(where $\bar{x}$=sample mean, S.E.= $\frac{s}{\sqrt{n}}$ )*

• 95% Confidence interval for proportion = **p +/- 2 S.E.** *(where p=proportion of cases in sample with this value, q=1-p, S.E.= $\frac{\sqrt{p*q}}{\sqrt{n}}$ )*

## 2-sample Hypothesis Tests:

• Difference of means: $t_{Observed} = \frac{\text{Difference between sample means}}{\text{Dispersion of sample}} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{(s_{xbar1}^2 + s_{xbar2}^2)}}$

*(where $\bar{x}_1$ and $\bar{x}_2$=sample means, $s_{xbar1}$ and $s_{xbar2}$=sample means, $s_{xbar}$=$\frac{2}{\sqrt{n}}$)*

• ANOVA: $F = \frac{\text{Avg variation between}}{\text{Avg variation within}} = \frac{\text{Explained variance (IV)}}{\text{Unexplained variance (error)}}$

**Table 6-3** Proportions of the Normal Curve above the Absolute Value of $Z$

| First digit and first decimal of $Z$ | Second decimal of $Z$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *.00* | *.01* | *.02* | *.03* | *.04* | *.05* | *.06* | *.07* | *.08* | *.09* |
| 0.0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |
| 0.1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| 0.2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3859 |
| 0.3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| 0.4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| 0.5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| 0.6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| 0.7 | .2420 | .2389 | .2358 | .2327 | .2296 | .2266 | .2236 | .2206 | .2177 | .2148 |
| 0.8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| 0.9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| 1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| 1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| 1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| 1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| 1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| 1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| 1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| 1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| 1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| 1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | **.0250** | .0244 | .0239 | .0233 |
| 2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| 2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| 2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| 2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| 2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| 2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0054 | .0052 | .0051 | .0049 | .0048 |
| 2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| 2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |
| 2.8 | .0026 | .0025 | .0024 | .0023 | .0023 | .0022 | .0021 | .0021 | .0020 | .0019 |
| 2.9 | .0019 | .0018 | .0018 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 |
| 3.0 | .0013 | .0013 | .0013 | .0012 | .0012 | .0011 | .0011 | .0011 | .0010 | .0010 |

**Table 6-4** The Student's *t*-Distribution

| | Area under the curve | | | |
|---|---|---|---|---|
| Degrees of freedom | *.10* | *.05* | *.025* | *.01* |
| 1 | 3.078 | 6.314 | 12.706 | 31.821 |
| 2 | 1.886 | 2.920 | 4.303 | 6.965 |
| 3 | 1.638 | 2.353 | 3.182 | 4.541 |
| 4 | 1.533 | 2.132 | 2.776 | 3.747 |
| 5 | 1.476 | 2.015 | 2.571 | 3.365 |
| 6 | 1.440 | 1.943 | 2.447 | 3.143 |
| 7 | 1.415 | 1.895 | 2.365 | 2.998 |
| 8 | 1.397 | 1.860 | 2.306 | 2.896 |
| 9 | 1.383 | 1.833 | 2.262 | 2.821 |
| 10 | 1.372 | 1.812 | 2.228 | 2.764 |
| 11 | 1.363 | 1.796 | 2.201 | 2.718 |
| 12 | 1.356 | 1.782 | 2.179 | 2.681 |
| 13 | 1.350 | 1.771 | 2.160 | 2.650 |
| 14 | 1.345 | 1.761 | 2.145 | 2.624 |
| 15 | 1.341 | 1.753 | 2.131 | 2.602 |
| 16 | 1.337 | 1.746 | 2.120 | 2.583 |
| 17 | 1.333 | 1.740 | 2.110 | 2.567 |
| 18 | 1.330 | 1.734 | 2.101 | 2.552 |
| 19 | 1.328 | 1.729 | 2.093 | 2.539 |
| 20 | 1.325 | 1.725 | 2.086 | 2.528 |
| 21 | 1.323 | 1.721 | 2.080 | 2.518 |
| 22 | 1.321 | 1.717 | 2.074 | 2.508 |
| 23 | 1.319 | 1.714 | 2.069 | 2.500 |
| 24 | 1.318 | 1.711 | 2.064 | 2.492 |
| 25 | 1.316 | 1.708 | 2.060 | 2.485 |
| 26 | 1.315 | 1.706 | 2.056 | 2.479 |
| 27 | 1.314 | 1.703 | 2.052 | 2.473 |
| 28 | 1.313 | 1.701 | 2.048 | 2.467 |
| 29 | 1.311 | 1.699 | 2.045 | 2.462 |
| 30 | 1.310 | 1.697 | 2.042 | 2.457 |
| 40 | 1.303 | 1.684 | 2.021 | 2.423 |
| 60 | 1.296 | 1.671 | 2.000 | 2.390 |
| 90 | 1.291 | 1.662 | 1.987 | 2.368 |
| 100 | 1.290 | 1.660 | 1.984 | 2.364 |
| 120 | 1.289 | 1.658 | 1.980 | 2.358 |
| 1,000 | 1.282 | 1.646 | 1.962 | 2.330 |
| Normal (*Z*) | 1.282 | 1.645 | 1.960 | 2.326 |