PSYC 301: Advanced Statistical Inference
Mondays 1:00 – 2:20 pm and Wednesdays 11:30 am – 12:50 pm
Dunning Hall Room 14
Fall 2017

Course Instructor: Jill A. Jacobson, Ph.D.
  Email: jill.jacobson@queensu.ca
  Office: Craine 318
  Office Hours: By appointment – Click on "Sample Service" at the link below to schedule a meeting
  http://my.setmore.com/bookingpage/cdc11dc5-c12f-48a0-806e-751124e7b7b7

Head Teaching Assistant: Mark Khei
  Email: z.khei@queensu.ca
  Office: Humphrey 219
  Office Hours: By appointment

Office Hours/Appointments

You should take advantage of the opportunity to meet with the instructor and the Head TA. You also should feel free to ask questions during class/lab and/or immediately before or after it. If you are having trouble understanding the course material, please see the instructor and/or TA well in advance the exams. We want you to do well and learn the material in this course, but we can do little to help you if you do not take the initiative. Waiting until the last minute will not be a wise strategy.

Teaching Assistants

The TAs lead the tutorials and grade the in-lab quizzes and lab assignments. They do <u>not</u> grade the exams. The TAs will be available for the full three hours of their scheduled lab time. Thus they are not required to hold any additional office hours, and you are strongly encouraged to take advantage of their availability during the lab times. Your TA is unlikely to monitor the onQ discussion board, but the Head TA and instructor will be able to answer questions about the lab material. The TAs want to help you, but bear in mind that the volume of emails generated even by one lab section in this course can be enormous. So please use email conscientiously and sparingly. Unnecessary inquiries limit your TA's ability to respond to important emails. If you do have questions or need to meet with your TA, please contact him or her well in advance. If you wait until the last minute, you have no guarantee that your TA will have the opportunity to read your email and/or be able meet with you in time.

Section	Day	Time	TA	Email Address
005	Monday	2:30 pm - 5:30 pm	Mark Khei	z.khei@queensu.ca
007	Monday	5:30 pm - 8:30 pm	Andrew Nguyen	12aan3@queensu.ca
003	Tuesday	8:30 am - 11:30 am	Matt Kan	8mphk@queensu.ca
008	Tuesday	11:30 am - 2:30 pm	Andrew Nguyen	12aan3@queensu.ca
006	Tuesday	2:30 pm - 5:30 pm	Suhui Yap	12sy30@queensu.ca
002	Tuesday	5:30 pm - 8:30 pm	Thomas Vaughan-Johnston	13tvj@queensu.ca
004	Wednesday	2:30 pm - 5:30 pm	Thomas Vaughan-Johnston	13tvj@queensu.ca

Course Materials
Copyright

in Canadian Copyright law. Copying the PSYC 301 course material for distribution (e.g., uploading material to a commercial third-party website) can lead to a violation of Copyright law. Find out more about copyright here: http://library.queensu.ca/copyright.

Required Free Texts

Ismay, C., & Kim, A. Y. (2017). *Modern Dive: An Introduction to Statistical and Data Sciences via R*. Available at http://moderndive.com/

Navarro, D. J. (2015). *Learning Statistics with R: A Tutorial for Psychology Students and Other Beginners*. Available at http://www.compcogscisydney.com/learning-statistics-with-r.html?fref=gc&dti=346735129027556.

Wickham, H., & Grolemund, G. (2016). *R for Data Science*. Available at http://r4ds.had.co.nz/

Required Free Software

R software for Windows or Mac OS. R Core Team (2013). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

RStudio software for Windows or Mac OS. Studio Team (2015). *RStudio: Integrated Development for R*. RStudio, Inc., Boston, MA URL http://www.rstudio.com/.

Required Subscriptions

DataCamp. No subscription is necessary for modules assigned in this course; your account will be free. Go to https://www.datacamp.com/groups/bfb1441c80783fbdba66283a7f8a0b4d69e6b360/invite or follow the instructions in the invite email sent to you.

Top Hat. The subscription options are $26 per semester, $38 per year, or $75 for a lifetime account. Go to https://tophat.com/educational-technology/pricing/ or follow the instructions in the invite email sent to you. The app is available for computers, tablets, and/or smartphones.

Web Content

Additional information for the course will be available on onQ including links to readings and videos and discussion forums for course questions. Because students' questions tend to be similar, **please post your queries in the appropriate onQ discussion board rather than emailing the Head TA or the instructor directly.** We will check the discussion boards regularly and will respond to your questions there. This way everyone in the class has access to the same information. If you do email questions that should have been posted on onQ, please see onQ for the reply. As in PSYC 100, the message boards are intended only as a forum for posting questions and discussing topics related to the PSYC 301 course material. Messages pertaining to inappropriate topics like mark changes, course complaints, or subjects unrelated to PSYC 301 content will be deleted, and if those messages are deemed harassing, abusive, or insulting, disciplinary action will be taken.

Turnitin Statement

Queen's University has partnered with the third-party application Turnitin to help maintain our standards of excellence in academic integrity. Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. Submitted files are compared against an extensive database of content, and Turnitin produces a similarity report and a similarity score for each assignment. A similarity score is the percentage of a document that is similar to content held within the database. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.

All written assignments in this course including the exams must be originally and individually written. If you are uncertain about what constitutes plagiarism, please see the section below labeled *Academic Integrity*. All written assignments including the midterm and final exams must be submitted to Turnitin in electronic format (e.g., Word, PDF, etc.).

Calculators
No calculators will be needed for this course. All computations will be done in R.

Accessibility
Queen's is committed to an inclusive campus community with accessible goods, services, and facilities that respect the dignity and independence of persons with disabilities. Materials for this course will be made available in an accessible format or with appropriate communication supports upon request.

Privacy Statement
This course makes use of DataCamp for lab prep exercises, Top Hat for quizzing and attendance, and Turnitin for lab assignments and exams. Be aware that by logging into Turnitin, you will be leaving onQ, and accessing Turnitin's website and program. Your independent use of these sites, beyond what is required for the course (for example, purchasing the company's products), is subject to each company's terms of use and privacy policy. You are encouraged to review these documents, using the links below, before using the sites.

- DataCamp - https://www.datacamp.com/privacy-policy
- Top Hat - https://tophat.com/legal/privacy-policy/
- Turnitin - http://turnitin.com/en_us/about-us/privacy

Course Purpose
The primary purpose of this course is for you to become a better consumer of research. You will be expanding on the knowledge you gained in PSYC 202 (or equivalent course) and PSYC 203 to better understand statistical inference and make better judgments about what research you should and should not trust. You also will be developing marketable skills in programming and conducting statistical tests in R and translating statistical results into understandable language.

Intended Student Learning Outcomes
After completing this course, you will be able to:
1. Evaluate the trustworthiness of the statistical inferences made in research reports
2. Identify research practices that make statistical inferences more or less reliable and valid
3. Program and work with data in R
4. Conduct statistical analyses (univariate tests through factorial ANOVA) in R
5. Interpret and communicate the results of statistical analyses

Class Procedures
This course involves two 80-minutes lectures and one 3-hour lab per week. A variety of methods (e.g., lectures, practice exercises, lab assignments, quizzes, exams, etc.) will be used to support you in achieving the intended learning outcomes:

Grade Scheme
LABORATORIES

ASSIGNMENT TOTAL	Best 9 of 11 assignments	25%
R PREP TOTAL	Exercises completed prior to lab	5%
QUIZ TOTAL	Best 80 of 100 quiz questions	20%
EXAM TOTAL	2 Exams (best grade = 25%, other exam = 20%)	45%
PARTICIPATION TOTAL	Lecture attendance/quizzes	5%
GRAND TOTAL		100%

Laboratories

All labs are held in Humphrey Hall Room 219 and will begin during the 1st week of the term. No lab meetings will be held during the week of Thanksgiving (October 9-13). Laboratories will focus on: 1) weekly quizzes of the prior week's lecture material administered using the Top Hot app; 2) learning to program in R via RStudio; 3) reviewing statistical techniques and conducting the tests in R; and 4) a weekly assignment to be uploaded to Turnitin at the end of the lab. You are expected to attend your assigned laboratories for the full three hours and to participate in and complete all laboratory activities.

If you cannot attend your regular lab one week due to a religious observance or with documentation of a serious, extenuating (beyond your control) circumstance such as an illness (physical or mental), a death in the family, etc., you may attend an alternate lab as a visitor *for that week only*. Please contact the TA whose lab you are visiting in advance to let him or her know that you will be attending and to ensure that space is available. Also, please let your regular TA know that you will be attending another lab for that week only.

Lab assignments. The weekly lab assignments will consist of exercises in R. These assignments will be completed during the lab, so your TA can assist you with any problems, and they must be submitted to Turnitin at the end of the lab. Lab assignments will receive letter grades, and late assignments will be penalized two letter grades per each day late (i.e., if you earn a B+, your grade will be a B- once the penalty is applied). Your final lab assignment grade, which is 25% of your final grade, will be based on the best 9 out of 11 assignments.

R prep. To encourage you to prepare for your lab sessions, some weeks you will be asked to provide proof of completion for exercises done prior to lab. These exercises will consist of activities like answering selected Learning Check questions in *Modern Dive* or completing online modules at DataCamp.

Quizzes. The 10 weekly quizzes will consist of 10 multiple choice, true-false, and short answer questions mostly on the previous week's lecture material, but a few questions from earlier lectures also will be included. We are using quizzes because they encourage you to bring information to mind from memory, which is a very effective way to learn. This technique is called *retrieval practice*. Revisiting earlier material is a means of effecting two other useful techniques for learning, *interleaving* and *spaced practice*. You'll be hearing a lot more about these learning strategies in this class. The quizzes will be administered and graded using the Top Hat app, so feedback can be provided to you immediately. The TAs also will review each question as necessary to ensure that you understand the material before moving on to the next quiz question. Quizzes will be graded using letter grades, and your final quiz grade, which is 20% of your final grade, will be based on the best 80 out of 100 quiz questions.

Exams

Both the midterm and the final will be take-home exams submitted to Turnitin.com. The midterm will be due by 11:59 pm on Wednesday, October 11, 2017, and the final exam will be due by 11:59 pm on Tuesday, December 12, 2017. Both exams will receive letter grades. The exam on which you perform the best will be worth 25% of your final grade, and the other exam will be worth 20% of your final grade. You are expected to write all exams as scheduled, and you must write all exams to pass this course (i.e., if you do not write an exam, you will receive a failing mark for the class regardless of your performance on the other components of the course). If you are unable to write an exam, appropriate documentation of your reasons for not writing the exam must be submitted to and approved by the instructor **PRIOR** to the exam (specifically, by 5:00 pm the day before the exam is due). For more information, see the section *Missed Exams* below. Exams and assignments due in other courses will not be sufficient grounds for excusal, and the PSYC 301 exam dates will not be changed to accommodate conflicts with your other courses' schedules. Furthermore, exams will not be moved or deferred to accommodate employment, travel/holiday plans, or flight reservations. Late exams will be penalized two letter grades per each day late (i.e., if you earn an A on the exam, your grade will be a B+ once the penalty is applied).

Missed exams. If you cannot submit the final exam during the December exam period due to a serious, extenuating circumstance (illness, death in the family), you must follow the steps below to be eligible to write a deferred exam during the PSYC department's *Make up Exam period* in January, April/May, and September.

1. Obtain permission from your instructor to write a deferred exam. This requires notifying your instructor in advance or, under extraordinary circumstances, within 72 hours after, the exam, with appropriate

documentation.[1] Please use the *Request for an Exam Deferral* form found on the Department website or from the UG office and attach your documentation.

2. Complete and return the instructor-signed *Permission for an Incomplete Grade* form available on the Arts and Science website and return to the UG office.

3. Be available to write the makeup exam the PSYC department's *Make up Exam period* in January, April/May, or September or receive '0' on the exam.

NOTE: If you do not write the makeup exam, you are advised to drop the course. If you cannot write the makeup exam due to a serious extenuating circumstance for which you can provide new documentation, you will either be granted a second deferral by your instructor or be supported in your appeal to drop the course after the deadline though this decision rests with the Associate Dean (Studies).

Accommodation after the fact. Once you have submitted an assignment or an exam, you may not subsequently be granted accommodation such as being offered a second opportunity to write the exam or assignment or have it count for less than originally specified in the course syllabus (reweighted).

Grading Method

In this course, all components will receive letter grades, which for purposes of calculating your course average will be translated into numerical equivalents using the Faculty of Arts and Science approved scale (see below). Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale (see below).

Arts & Science Letter Grade Input Scheme

Assignment mark	Numerical value for calculation of final mark
A+	93
A	87
A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Accommodations

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Wellness Services (SWS) and register as early as possible. For more information, including important deadlines, please visit the Student Wellness website at: http://www.queensu.ca/studentwellness/accessibility-services. If you do qualify to receive

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[1] Appropriate documentation includes a signed letter from a registered health professional, Queens HC&DS, or documentation of a death such as a bulletin from a memorial service, obituary (newspaper or online) or funeral home letter. Official documents will be copied and originals returned to the student. Note that the PSYC department randomly checks document authenticity and that fraudulent documents will be grounds for a finding of a major departure from academic integrity

special accommodations, please notify the instructor right away, so any special arrangements can be made as soon as possible. The instructor will inform your TA for you, so you do not have to have this discussion twice.

Academic Consideration for Students in Extenuating Circumstances

The Senate Policy on Academic Consideration for Students in Extenuating Circumstances (http://www.queensu.ca/secretariat/sites/webpublish.queensu.ca.uslcwww/files/files/policies/Extenuat ingCircumstancesPolicyFinal.pdf) was approved in April, 2017. Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and which have a direct and substantial impact on their ability to meet essential academic requirements. The Faculty of Arts and Science is developing a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances, which will be posted on the Faculty of Arts and Science website in Fall, 2017.

Academic Integrity

Academic Integrity is constituted by the six core fundamental values of honesty, trust, fairness, Respect, responsibility and courage (see www.academicintegrity.org). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities).

You are responsible for familiarizing yourself with the regulations concerning academic integrity and for ensuring that your assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1), on the Arts and Science website (see http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Course Outline

Week	Lecture Dates	Lecture Topic	Assigned Readings/Podcasts	Lab Schedule
1	September 11 September 13	Introduction Crisis in Science	LSR1 Why do we learn statistics? Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science, 22*(11), 1359-1366. John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the prevalence of questionable research practices with incentives for truth telling. *Psychological Science, 23*(5), 524-532. https://player.fm/series/96539/121666139	TA Introduction LSR3 Getting Started with R Assignment 1 Due
2	September 18 September 20	Crisis (continued)	LSR2 A brief introduction to research design http://www.sas.upenn.edu/~deenas/papers/hopkins-et-al-cognition2016.pdf http://www.nature.com/nrn/journal/v14/n5/pdf/nrn3475.pdf http://biorxiv.org/content/biorxiv/early/2016/06/16/059188.full.pdf	Turnitin Top Hat Quiz 1 LSR4 Additional R Concepts Assignment 2 Due
3	September 25 September 27	NHST and *p* values	LSR9 Introduction to probability LSR10 Estimating unknown quantities from a sample http://www.ohri.ca/newsroom/seminars/SeminarUploads/1829%5CSuggested%20Reading%20-%20Nov%203,%202014.pdf http://blogs.plos.org/absolutely-maybe/2016/04/25/5-tips-for-avoiding-p-value-potholes/ https://www.researchgate.net/profile/Raymond_Nickerson/publication/12384017_Null_hypothesis_significance_testing_A_review_of_an_old_and_continuing_controversy/links/5509ad3a0cf20ed529e17ee0.pdf http://rsos.royalsocietypublishing.org/content/1/3/140216 http://amstat.tandfonline.com.proxy.queensu.ca/doi/full/10.1080/00031305.2016.1154108	Quiz 2 LSR5 Descriptive Statistics Assignment 3 Due
4	October 2 October 4	Likelihood and Bayes	LSR11 Hypothesis testing LSR17 Bayesian statistics https://alexanderetz.com/2015/04/15/understanding-bayes-a-look-at-the-likelihood/ https://alexanderetz.com/understanding-bayes/ http://allendowney.blogspot.ca/2015/11/learning-to-love-bayesian-statistics.html?m=1	Quiz 3 MD3 Data Visualization via ggplot2 Assignment 4 Due
5	October 9 October 11	No Lecture Midterm Exam Due	Thanksgiving Upload to Turnitin by 11:59 pm	Cancelled
6	October 16 October 18	Power	http://www.statisticsdonewrong.com/power.html http://rpsychologist.com/d3/NHST/ http://daniellakens.blogspot.ca/2014/05/the-probability-of-p-values-as-function.html http://daniellakens.blogspot.ca/2014/12/observed-power-and-what-to-do-if-your.html	Quiz 4 MD4 Data Tidying via tidyr Assignment 5 Due
7	October 23 October 25	Sample Size Planning and Optional Stopping	Several links within this blog post that are worth reading to better understand power and sample size determination: https://pigee.wordpress.com/2016/09/13/the-power-dialogues/ http://daniellakens.blogspot.ca/2014/06/data-peeking-without-p-hacking.html http://daniellakens.blogspot.ca/2015/04/how-many-participants-should-you.html For more on Type M and Type S errors, see various blog posts by Andrew Gelman including http://andrewgelman.com/2004/12/29/type_1_type_2_t/	Quiz 5 MD5 Data Wrangling via dplyr Assignment 6 Due

8	October 30 November 1	Confidence Intervals, Effect Size, and Meta-Analysis	http://rpsychologist.com/d3/cohend/ http://rpsychologist.com/d3/correlation/ http://people.uncw.edu/galizio/PSY589/Cummings2014.pdf http://www.psychologicalscience.org/members/new-statistics http://rpsychologist.com/d3/CI/ http://www.statsblogs.com/2015/12/03/confidence-intervals-what-they-are-and-are-not/ http://datacolada.org/30 http://willgervais.com/blog/2015/6/25/putting-pet-peese-to-the-test-1	Quiz 6 LSR12 Categorical Data Analysis Assignment 7 Due
9	November 6 November 8	Multiple Comparisons and Error Control	Cramer, A. O., van Ravenzwaaij, D., Matzke, D., Steingroever, H., Wetzels, R., Grasman, R. P., ... & Wagenmakers, E. J. (2016). Hidden multiplicity in exploratory multiway ANOVA: Prevalence and remedies. Psychonomic Bulletin & Review, 23(2), 640-647. http://deevybee.blogspot.ca/2013/06/interpreting-unexpected-significant.html http://daniellakens.blogspot.ca/2016/01/error-control-in-exploratory-anovas-how.html http://andrewgelman.com/2016/05/25/the-difference-between-significant-and-not-significant-is-not-itself-statistically-significant-education-edition/ http://daniellakens.blogspot.ca/2016/05/absence-of-evidence-is-not-evidence-of.html http://doingbayesiandataanalysis.blogspot.ca/2016/10/should-researchers-be-correcting-for.html	Quiz 7 LSR13 Comparing Two Means Assignment 8 Due
10	November 13 November 15	Replication	http://nobaproject.com/modules/the-replication-crisis-in-psychology https://soundcloud.com/science-vs-season-1/science http://www.npr.org/2016/05/24/477921050/when-great-minds-think-unlike-inside-sciences-replication-crisis https://player.fm/series/96539/121666139 https://hardsci.wordpress.com/2012/10/05/what-counts-as-a-successful-or-failed-replication/ http://datacolada.org/47 http://blog.dansimons.com/2013/02/what-counts-as-successful-replication.html http://www.slate.com/articles/health_and_science/science/2014/07/replication_controversy_in_psychology_bullying_file_drawer_effect_blog_posts.html	Quiz 8 LSR14 Comparing Several Means Assignment 9 Due
11	November 20 November 22	QRP Detection Lecture Cancelled	https://mbnuijten.com/2016/09/26/httpstatcheck-io-now-online/ https://peerj.com/preprints/2748/	Quiz 9 LSR16 Factorial ANOVA Assignment 10 Due
12	November 27 November 29	Best Practices Review	Asendorpf, J. B., Conner, M., De Fruyt, F., De Houwer, J., Denissen, J. J., Fiedler, K., ... & Perugini, M. (2013). Recommendations for increasing replicability in psychology. European Journal of Personality, 27(2), 108-119. Funder, D. C., Levine, J. M., Mackie, D. M., Morf, C. C., Sansone, C., Vazire, S., & West, S. G. (2014). Improving the dependability of research in personality and social psychology. Personality and Social Psychology Review, 18(1), 3-12. Lakens, D., & Evers, E. R. (2014). Sailing from the seas of chaos into the corridor of stability practical recommendations to increase the informational value of studies. Perspectives on Psychological Science, 9(3), 278-292. Maner, J. K. (2014). Let's put our money where our mouth is if authors are to change their ways, reviewers (and editors) must change with them. Perspectives on Psychological Science, 9(3), 343–351.	Quiz 10 LSR15 Linear Regression Assignment 11 Due
EXAM	December 12	Final Exam Due	Upload to Turnitin by 11:59 pm	

Note. LSR = Learning Statistics with R; MD = Modern Dive