Biology 314: Introduction to Research Design

$$f(y) = \frac{\sqrt{\frac{(v_{l}y)^{v_{l}}v_{2}^{v_{2}}}{(v_{l}y + v_{2})^{v_{l} + v_{2}}}}}{y B\left(\frac{v_{l}}{2}, \frac{v_{2}}{2}\right)}$$

I. Instructor information:

Instructor: Arndt F. Laemmerzahl Office: Exploratory Hall, 1206 (Fairfax campus)

Phone: 993-5608 (note: *I do not check voice mail!*) e-mail: alaemmer@gmu.edu (the best way of getting a hold of me.)

Office hours: See web page

Class web page: I won't be using blackboard much; most of the same sort of information can be found on my web page for this class at:

http://mason.gmu.edu/~alaemmer/bio314/main.html

II. Books, manuals, etc.

Text: Biostatistical Analysis, 5th ed. Zar, J. 2010. Prentice-Hall

Comment: Many students don't like this text - it is true that it is not an ideal text to "read". But it is comprehensive and makes an excellent reference if you go on in research.

Warning: Please *do not* get the international edition as it misses several important parts of the text.

If you've forgotten a lot from BIOL 214, you may also benefit from an introductory statistics text such as the one on our web page (this is the same one used in BIOL 214).

If you want, you can also use something like the following for basic help with statistics:

Statistics for the Life Sciences. Samuels and Witmer, (any edition except the 1st or 5th). Second and third editions are available for as little as \$10.00 from Amazon and other used book vendors.

Software:

1) R statistical software:

Probably the best statistical software available. It is also better than most other non-free statistical software, and is available for Windows, Mac-OS, and Linux.

2) RStudio:

You want the free desktop version. RStudio is a very nice interface to R, and makes many things much easier (cutting and pasting, saving/restoring files, graphs, etc.).

Note that both of these are open source and free. Our website has detailed instructions for installing these.

Calculator: You should also make sure you have a calculator with statistical functions. Chances are that if you own a "fancier" (e.g. scientific) calculator it will include these functions. However, there are calculators available for as little as \$20.00 that will do (try, for example, the TI-30X IIS). You can use whatever brand you wish, but it is *your responsibility* to figure out how it works.

III. Exams:

Two exams. A midterm and a final:

Midterm: tentatively scheduled for Wednesday, October 9th. May move forward or back one class period depending on the material that has been covered.

Final exam: scheduled for Wednesday, December 11th, at 10:30 a.m. (*If possible, I may try to move this*).

The exams will be based mostly on the statistical techniques discussed in class, but will also include other material discussed in class.

Exams will most likely have two components - a closed book part and an open book part. Details presented in class.

Each exam is worth 30% of your grade.

IV. Homework:

You will be given weekly homework assignments. This will be discussed in recitation. Each homework assignment (there will about 10) is worth 2.5% of your grade (total = 25%). (If there are less than 10 assignments, your score will be adjusted to be worth 25%).

As part of the homework, you will be expected to use R. This will count toward your homework assignment. Note that you will not be able to complete some problems without using R (or at least, some problems would literally take you weeks without R).

Late homework assignments will be penalized at 50% if they are less than a week late. Assignments later that that are worth 0% and will not be graded.

The first homework assignment probably won't be sent out for several weeks after the start of the semester.

V. Presentations:

Each person will have two presentations due:

1) Presentation of your research design (worth 5%)

A very brief overview to let us know what research you are planning to do. This will be done *in recitation* near the beginning of the semester.

2) Presentation of data (your results) (worth 10%)

A more comprehensive presentation giving your results and achievements; similar to your poster, but using slides and with an audience (your classmates). This will be done in lecture the two weeks before Thanksgiving.

VI. Grading:

The following grading scale is used in this class:

A+	96 - 100
А	90 - 95
B+	86 - 89
В	80 - 85
C+	76 - 79
С	70 - 75
D	60 - 69
F	0 - 59

Note that I do not give (-) grades, but do give a few (+) grades.

VII. Miscellaneous:

Missed class - if for some reason class is canceled, then the following class will cover the material for the missed class. This is particularly important should an exam day be canceled for whatever reason (the exam will take place in our next scheduled class).

If you are having problems - please come and see me. I am here to help you learn this material *and* pass this class. I will do what I can to make sure that you make it successfully. Please don't wait too long if you are having difficulties.

Please try to be in class. You've probably heard it a million times already, but it's particularly true in this class. *You will probably not do well if you are absent too often.*

VIII. Tentative course outline (may change as the semester progresses):

Week of	Lecture topic	Recitation topic	Approx. text chapters
August 26	Introduction; Descriptive statistics; Samples and populations.	Introduction Installing R	3.1, 3.2, 4.1, 4.3-4.6,2.1- 2.4
September 2	Distributions	Using R - examples	6.1-6.4
September 9	<i>No class Monday (labor day)</i> Two sample tests;	TBD	7.1, 7.2, 8.1-8.3, 8.10, 8.11, 8.14
September 16	Paired two sample tests	Oral presentations	9.1, 9.5
September 23	Catch up	Oral presentations	
September 30	ANOVA designs	Homework discussion	10.1, 10.4
October 7	Review / catch up <i>Midterm exam (10/9)</i> (date is tentative)	Homework discussion	12.1 - 12.3, chapters 14 & 15, possibly outside material.
October 14	<i>No class Monday</i> <i>(Columbus day)</i> More complicated ANOVA designs	Homework discussion	TBD
October 21	More complicated ANOVA designs	Homework discussion	TBD
October 28	Misc. topics in statistics	Homework discussion	TBD
November 4	Misc. topics in statistics	Homework discussion	TBD
November 11	Presentation of data	Homework discussion	N/A
November 18	Presentation of data	Homework discussion	N/A
November 25	No class (Thanksgiving)*	No class (Thanksgiving)*	
December 2	No class	No class	N/A

(*Note that we will not meet (lecture or recitation) the week of Thanksgiving and the week following).

(Technically we have class on December 9th (Monday), but we won't be meeting).

IX. Learning outcomes:

- Understand basic measures for central tendency and spread.
- Become familiar with some vary basic distributions.
- Be able to carry out hypothesis tests such as various *T*-tests, MWU-tests, ANOVA, KW, etc.
- Understand basic concepts such as *p*-values, power, types of error, α , β , etc.
- Since this course is partly driven by student needs, other learning outcomes depend on topics that will be covered as a result of these student needs.

X. Relevant university information:

Academic integrity: GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit to those people in the proper, accepted form. When doing homework, the work must be yours. It is totally unacceptable to copy the work of another student in this course in any form.

Note: if you are caught cheating, you will be taken to the honor committee. No arguments.

GMU e-mail accounts: Students must use their Mason email accounts—either the existing "MEMO" system or a new "MASONLIVE" account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

Other useful campus resources:

Writing center: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu

University libraries (Ask a Librarian): http://library.gmu.edu/mudge/IM/IMRef.html

Counseling and psychological services (CAPS): (703) 993-2380; http://caps.gmu.edu

University policies: The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.