Instructor Information.

Dr. Benjamin PÉLISSIÉ
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Skype: benjaminpelissie

Please, contact me directly only for personal issues or questions. For general questions about the course (including technical issues and specific expectations), please ask them on our dedicated Discussion Board, so that everyone can benefit from my answer.

Since I am not in Kearney for this summer semester, you can reach me by email, by Skype.
  - For emails: I check email messages at least twice a day and will respond within 24 hours during weekdays. Under special (and rare) circumstances, and if I don’t judge your question as being urgent, I might take 2 days to respond.
  - For Skype: Please, prefer using emails for regular requests. If your request/enquiry is urgent, write me a message on Skype and we will decide together whether we need to talk about it or not. If you prefer to talk to me, please enquire a Skype appointment with me via email. If you call me on Skype right-away, I might not be able to pick up.

Course Description.

[from UNK Graduate catalog]

This class is divided into two main areas. The first is biological statistics: the collection and analysis of scientific data. The second area is experimental design: how an experimental hypothesis is built and what are the pieces and procedures needed to conduct a successful experiment. The class is not mathematically intensive and relies on the power of computers beyond a few examples done by hand. The class includes both parametric and non-parametric statistics with continuous and categorical variables. Offered online, every Fall and Spring.

Required Course Materials.

Whitlock, MC and D Schluter. 2014. The Analysis of Biological Data, 2nd Ed. 768 pp. WH Freeman Publisher.

First edition books can be used as well but there may be issues with page numbers, and both practice and assignment problem numbers will be different than second edition. This book is published by 2 publishers; but the 2nd edition from either publisher will be fine. Note: a third edition was published last January: you don’t have to buy it. The second edition will probably be way cheaper.

Introduction to the Course.

The goal of this course is to provide graduate students in the Life Sciences with an introduction to modern statistical practices. An understanding of the concepts will be stressed along with their applications to real-life situations. The development of the ability to interpret results and to evaluate critically the design and methods used will be of most importance.
Although mathematical complexity will be kept to a minimum and analysis of data will receive substantial attention, we will rely on simple algebraic analysis and demonstrations (mostly manipulating and solving simple equations), to understand how statistics work. To carry our analyses, we will use the software R (more specifically Rstudio), a programming language that is used widely, both in industry and the academic world. Although learning a programming language can seem overly challenging, you will be given full guidance and here again, complexity will be kept to the strict necessary. In the end, you will get hands on experience with (simple) computer programming, a skill in your resume that might be highly regarded.

Teaching will be done entirely online and includes lectures, readings, graded assignments, discussion sessions and exams. Every week, you are required to watch one lecture (you need an internet connection), read the corresponding (assigned) book chapters/sections, participate in discussions (via discussion board posts), complete a short quiz and a written homework assignment.

The study of statistics can seem somewhat scary and the associated material (including the present syllabus!) appear complex and “dry”. However, the learning curve is not as steep as it seems and often, students are amazed by how much and how quickly they end up learning about statistics. Once you master the basics and understand the core principals (which is the main goal of this course), statistics are also really fun, and you will get practical knowledge that is applicable to almost any aspect of life.

**Detailed Objectives (learning outcomes)**

After taking this course, you should be able to:

1. Understand the fundamental concepts of probability and inferential statistics.
2. Describe almost any type of data and understand their nature.
3. Have a critical opinion about (and be able to correct) statistical analyses carried by others.
4. Design your own experiments based on the statistical power needed to test the biological hypotheses you are investigating.
5. Carry your own statistical analyses using the R software and be introduced to a modern computer programming language.
6. Communicate your work in a precise, clear, sharable way.

**Lectures.**

(except for week 1; see below) Each week, 1 lecture will be available on Canvas on Monday, 1:00 p.m. CST. Lectures will be 1h-2h long, depending on the topics covered. Lectures are designed to provide in-depth presentation of the studied concepts, and from a perspective that is different from that of the textbook. Producing one long lecture per week (as opposed to 2 or 3) is a deliberate choice that should allow you to focus on applying the covered concepts and techniques throughout the rest of the week, as well as to prepare your homework. This course design should also give you a lot of control over your schedule and the way you decide to learn.

Note that Lecture 1 will be available Wednesday 13, at 1:00 p.m.
Quizzes. [10% final grade]

Each week, after watching the lecture, you will take a 10-questions, multi-choice quiz, to assess your level of understanding of the week’s material. The quizzes will be timed (15 minutes) graded, and 2 attempts will be allowed, to provide you with the opportunity to identify and work on the unmastered material.

Readings.

Lectures are designed to be self-sufficient and should be enough for you to understand the concepts and methods we will cover and prepare yourself for the exams. However, I strongly advise you to read the associated chapters from the textbook every week, either before or after viewing the lecture Whitlock, MC and D Schluter. 2014. The Analysis of Biological Data, 2nd Ed. (please see the Course Schedule). Assigned readings will be available on Canvas with every lecture.

The textbook will be of prime importance in:
- Serving as a reference for all the subjects covered in lectures.
- Offering you the opportunity to get slightly different perspective on the subjects covered (sometimes reading the same information in a slightly different way is enough to unlock my brain!).
- Providing you with practice problems (incl. solutions) to assess your performance and progress throughout the class.
- Presenting various real-life examples and graphical representations to illustrate the ideas we will be discussing.

Note: The lectures won’t follow the textbook strictly linearly (once again, the goal is to offer 2 different, complementary perspectives). Not all the book sections will be covered in the lectures (unnecessary readings will be specified every week).

Discussions. [20% final grade]

Discussions are a significant portion of this course. They will allow you to share information, challenge others’ opinions and get your own ideas challenged. Each week, I will post a subject on a new Discussion Board at the same time as the week’s lecture. Discussion boards will be open from Monday 1:00 p.m. to Sunday 11:59pm CST. To expect 80% of the credits (and assuming fair-quality posts), you will have to write at least 3 posts, during at least 3 different days, of at least 100 words each. The remaining 20% of the grade will allocated to more comments, longer ones, in-depth first post, etc. While then first and last discussion boards (DB) will involve everyone, DB.2 to DB.11 will be done in smaller groups of 4-5 students, allowing for more in-depth exchanges and decreased reading loads.

Guidelines for the discussion posts:
The more thoughtful your comments, the better the quality of discussion will be for the entire class. When needed, your comments/statements should be supported with information, file attachments or web sites, and should be relevant to the current topic of discussion. References are encouraged but shouldn’t be over-utilized (be specific!). Comments should be at least a few sentences and demonstrate that you are aware of the discussion that has been taking place. While you can answer “I agree” to someone else’s statement (it is useful and fair to encourage good comments), it will typically not be counted as one of comments needed to obtain full credits (see above) in
the week’s discussion. Overall, conciseness and clarity are necessary (i.e. page long postings might not be appropriate), both to keep the reading load for the class to a reasonable level and to state your reasoning as precisely and as efficiently as possible.

Finally, I expect you to be polite, professional and constructive, for each discussion to be as useful and enjoyable as possible.

**Homework Assignments. [30% final grade]**

There will be weekly homework assignments. Doing homework on a regular basis is the best way to learn. Much of your learning will take place while working the problems. Homework has 2 aspects: (i) it is THE way to make yours all what you read and listen to, and (ii) it will provide you with feedback on your work, allowing you to assess your progress through the class.

(Except for HW.1; see below) Every week, homework will be available on Monday at 11:59 a.m. CST, and due the following Sunday before 11:59 p.m. CST. Do not underestimate the time needed to complete your assignments on time. Again, no late submission will be accepted. Your submissions should be clear, organized and easy to read: points will be docked if your homework assignment is hard to get through. I will provide solutions for every homework as soon as I can, hopefully on the following Monday, along with the new lecture.

In this class, collaboration on Homework will be allowed, if not promoted: every week, a discussion board dedicated to the week’s lecture and homework will be open, allowing you, as a learning group, to collaborate, troubleshoot your analyses, and share your perspectives on the material. These discussion boards will not be graded, and you have no obligation to participate, although I would still advise you to. Note: while collaborative, homeworks are graded individually.

Note: the first homework (HW.1) will be available Wednesday 13, at 5:00 p.m. and due Sunday 10, at 11:59 p.m. CST.

One advice: organize your homework solutions neatly: it will help you for the exams.

**Format requirements.**

- Your homework will require you to write equations: to do so, you are expected to use an equation module, present in either Microsoft Office, LibreOffice or Google Docs productivity suites to produce your assignments (a video tutorial will be posted on Canvas during week 1). Whatever software you choose, your submission to Canvas should be in a .pdf file format (all text editors mentioned above support PDF exports). No other format will be accepted.

- Your homework will require you to carry analyses using R: you will need to embed your script (the commands you use), the results obtained via the R console and the graphics you produce in your document (a video tutorial will be posted on Canvas during week 1). Again, be as clear and organized as possible.

**WARNING:** any case of plagiarism will result in a 0 for the impacted assignment.
Exams. [40% final grade]

There will be 1 final exam (week 12), covering lecture materials, discussions, homework and readings, and aimed at evaluating your understanding of the concepts and techniques presented in the lectures. They will include both questions/answers and some data exploration and analyses to do in R.

The exam will consist in 4 assignments: 3 separate problems and 1 multi-choice quiz. The format of each problem will be similar to that of the Homework, and both expectations and requirements will be the same as for Homework. You will have 2h (from the moment you open the assignment) to complete each problem and submit to Canvas. The format of the Final quiz will be similar to that of the weekly quizzes, although involving more questions (15-25; to be determined). You will be able to take of the 4 assignments whenever you want and in the order you want, over the course of the final week.

Note: no weekly assignment will be posted during the Final week, in order to free up time for you to prepare and take the exam (and potentially to catch-up on some sections).

WARNING: any case of plagiarism will result in a 0 for the impacted assignment.

Late Work.

Every assignment must be submitted before its deadline (please see corresponding sections and the course schedule). Late assignments will not be accepted. Because technical difficulties happen, I advise you to not wait to submit your assignments. Also, backup your data safely, so that you don’t lose your work if your computer crashes, gets stolen, gets a virus, etc. It happens to someone every year, and it might be you this time! There is nothing I will be able to do about it.

You must check in with Canvas regularly. Look at your grades to see if your scores are recorded and are correct. If a grade is missing, you must inform me promptly. Waiting until the end of the semester is unacceptable and I can do nothing at that point.

Computer and Software Requirements.

For this class, you will need to have frequent access to a computer with internet connectivity. Lectures will require internet access to be viewed. Again, I expect you to check Canvas site several times per week, ideally every day. Please refer to the eCampus website to make sure you meet the minimum hardware/software and internet connection speed required by all UNK eCampus students. You will need to use a productivity suite (either Microsoft Office, LibreOffice or Google Docs) to produce all your assignments and exams.

Statistical analyses.

Authentic experience with modern statistical practice cannot bypass the use of a computing tool. We will with the programming language R, which is free, widely used (especially in Biology) and available on most platforms (i.e. Windows, Mac and Linux). Because the use of R can be challenging, we will more specifically use the software Rstudio, that is a friendlier graphical interface to R. Rstudio is available on most platforms, but also as a cloud service; it might be a good solution for you if you are working on a Chromebook, or just prefer to bypass the software installation process altogether.
There is no assumption in this course of prior experience with R, Rstudio or with any other particular software. All information you need to use R and Rstudio will be provided to you. Most homework assignments will require the use of R.

**Grading.**

Your grade will be based on your performance and progress to reach the course learning outcomes in four areas of assessment:

1) Weekly Quizzes (over 12 weeks) 10%
2) Weekly Discussion Boards (over 12 weeks) 20%
3) Weekly Homework (over 12 weeks) 30%
4) Final Exam (Week 12) 40%

**Grade scale:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100 % to 93.0%</td>
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<tr>
<td>A-</td>
<td>&lt; 93.0 % to 90.0 %</td>
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<tr>
<td>B+</td>
<td>&lt; 90.0 % to 88.0 %</td>
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<tr>
<td>B</td>
<td>&lt; 88.0 % to 83.0 %</td>
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<tr>
<td>B-</td>
<td>&lt; 83.0 % to 80.0 %</td>
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<tr>
<td>C+</td>
<td>&lt; 80.0 % to 78.0 %</td>
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<tr>
<td>C</td>
<td>&lt; 78.0 % to 73.0 %</td>
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<tr>
<td>C-</td>
<td>&lt; 73.0 % to 70.0 %</td>
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<tr>
<td>D+</td>
<td>&lt; 70.0 % to 68.0 %</td>
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<tr>
<td>D</td>
<td>&lt; 68.0 % to 63.0 %</td>
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<tr>
<td>D-</td>
<td>&lt; 63.0 % to 60.0 %</td>
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<tr>
<td>F</td>
<td>&lt; 60.0 % to 0.0 %</td>
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</table>

*Important / interesting observation on the grading scheme:* Note that weekly assignments (quizzes + discussions + homework) are worth 60% of your final grade. As an example, it means that if you maintain a 80% partial on weekly assignments overall and score 65% on the final exam, you will still receive a C, as 

\[
0.6 \times 0.8 + 0.4 \times 0.65 = 0.74
\]

*Important notes on grading in general:*

- Minor modifications to assigned points may occur and will be announced.
- Your final grade will be automatically rounded up to the nearest integer (no need to ask for it!).
- Please, do not contact me to increase your grade; I will not do it.

**Academic Integrity.**

By enrolling in this course, each student assumes the responsibilities of an active participant in UNK’s community of scholars in which everyone’s academic work and behavior are held to the highest
academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action.

**Students with Disabilities.**

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students with documented disabilities. To receive accommodation services for a disability, students must be registered with UNK Disabilities Services for Students Office, 172 Memorial Student Affairs Building, 308-865-8988 or by email unkdso@unk.edu.

**Students Who are Pregnant.**

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students who are pregnant. To receive accommodation services due to pregnancy, students must contact Cindy Ference in Student Health, 308-865-8219.


**Reporting Student Sexual Harassment, Sexual Violence or Sexual Assault**

Reporting allegations of rape, domestic violence, dating violence, sexual assault, sexual harassment, and stalking enables the University to promptly provide support to the impacted student(s), and to take appropriate action to prevent a recurrence of such sexual misconduct and protect the campus community. Confidentiality will be respected to the greatest degree possible. Any student who believes she or he may be the victim of sexual misconduct is encouraged to report to one or more of the following resources:

- Local Domestic Violence, Sexual Assault Advocacy Agency: 308-237-2599
- Campus Police (or Security): 308-865-8911
- Title IX Coordinator: 308-865-8655

Retaliation against the student making the report, whether by students or University employees, will not be tolerated.

**Course Schedule.**

Here is the course schedule that we will follow this semester. Slight changes might occur; they will be communicated in time, on Canvas.

I am gladly willing to try to accommodate (thus with a priori guaranty) students under exceptional conditions. If it is your case, you need to contact me at the beginning of the semester (within the first 2 weeks). Afterwards – I won’t be able to do anything.

!!Notice of any conflict (religious or other) with these dates must be given to me within the first week!!
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture</th>
<th>Weekly Quiz</th>
<th>Weekly Discussion Board</th>
<th>Weekly Homework</th>
<th>Final Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Thursday, May 7, 2020</td>
<td>[course available on Canvas]</td>
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</tr>
<tr>
<td>1</td>
<td>Monday, May 11, 2020</td>
<td>1. Presentation and Introduction</td>
<td>Quiz 1 open</td>
<td>DB.1 open</td>
<td></td>
<td>HW.1 prompt</td>
</tr>
<tr>
<td></td>
<td>Wednesday, May 13, 2020</td>
<td>2. Data display and descriptive statistics.</td>
<td>Quiz 1 closed</td>
<td>DB.1 closed</td>
<td></td>
<td>HW.1 deadline</td>
</tr>
<tr>
<td></td>
<td>Sunday, May 17, 2020</td>
<td>3. Probability and Random Variables</td>
<td>Quiz 2 open</td>
<td>DB.2 open</td>
<td></td>
<td>HW.2 prompt</td>
</tr>
<tr>
<td></td>
<td>Monday, May 18, 2020</td>
<td>4. Binomial, Normal and Sampling Distributions</td>
<td>Quiz 2 closed</td>
<td>DB.2 closed</td>
<td></td>
<td>HW.2 deadline</td>
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<td></td>
<td>Sunday, May 24, 2020</td>
<td>5. Hypothesis testing and analyzing proportions</td>
<td>Quiz 3 open</td>
<td>DB.3 open</td>
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<td>HW.3 prompt</td>
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<td></td>
<td>Sunday, May 31, 2020</td>
<td>6. Chi-square test for proportions</td>
<td>Quiz 3 closed</td>
<td>DB.3 closed</td>
<td></td>
<td>HW.3 deadline</td>
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<tr>
<td>4</td>
<td>Monday, June 1, 2020</td>
<td>7. Comparing proportions and testing independence/association</td>
<td>Quiz 4 open</td>
<td>DB.4 open</td>
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<td>HW.4 prompt</td>
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<td></td>
<td>Sunday, June 7, 2020</td>
<td>8. Analysis of 1 sample and comparison of 2 paired samples</td>
<td>Quiz 4 closed</td>
<td>DB.4 closed</td>
<td></td>
<td>HW.4 deadline</td>
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<tr>
<td>5</td>
<td>Monday, June 8, 2020</td>
<td>9. Analyzing 2 independent samples and violations of assumptions</td>
<td>Quiz 5 open</td>
<td>DB.5 open</td>
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<td>HW.5 prompt</td>
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<td></td>
<td>Sunday, June 14, 2020</td>
<td>10. Analysis of variance</td>
<td>Quiz 5 closed</td>
<td>DB.5 closed</td>
<td></td>
<td>HW.5 deadline</td>
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<tr>
<td>6</td>
<td>Monday, June 15, 2020</td>
<td>11. Regression and correlation</td>
<td>Quiz 6 open</td>
<td>DB.6 open</td>
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<td>HW.6 prompt</td>
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<td></td>
<td>Sunday, June 21, 2020</td>
<td></td>
<td>Quiz 6 closed</td>
<td>DB.6 closed</td>
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<td>HW.6 deadline</td>
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<td>Monday, June 22, 2020</td>
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<td>Quiz 7 open</td>
<td>DB.7 open</td>
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<td>HW.7 prompt</td>
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<td>Sunday, June 28, 2020</td>
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<td>Quiz 7 closed</td>
<td>DB.7 closed</td>
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<td>HW.7 deadline</td>
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<td>8</td>
<td>Monday, June 29, 2020</td>
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<td>Quiz 8 open</td>
<td>DB.8 open</td>
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<td>HW.8 prompt</td>
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<td></td>
<td>Sunday, July 5, 2020</td>
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<td>Quiz 8 closed</td>
<td>DB.8 closed</td>
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<td>9</td>
<td>Monday, July 6, 2020</td>
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<td>Quiz 9 open</td>
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<td>HW.9 prompt</td>
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<td>Sunday, July 12, 2020</td>
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<td>Quiz 9 closed</td>
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<td>HW.9 deadline</td>
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<td>10</td>
<td>Monday, July 13, 2020</td>
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<td>Quiz 10 open</td>
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<td>HW.10 prompt</td>
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<td>Sunday, July 19, 2020</td>
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<td>Quiz 10 closed</td>
<td>DB.10 closed</td>
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<td>HW.10 deadline</td>
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<tr>
<td>11</td>
<td>Monday, July 20, 2020</td>
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<td>Quiz 11 open</td>
<td>DB.11 open</td>
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<td>HW.11 prompt</td>
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<td>Saturday, July 25, 2020</td>
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<td>Quiz 11 closed</td>
<td>DB.11 closed</td>
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<td>Final exam open</td>
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<td>12</td>
<td>Friday, July 31, 2020</td>
<td></td>
<td>Quiz 11 closed</td>
<td>DB.11 closed</td>
<td></td>
<td>Final exam deadline</td>
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