Course Guidelines

University of Puget Sound

Dr. Beezer

Combinatorics

Math 420

Spring 2019

Texts   There are numerous open textbooks for combinatorics and graph theory, and I am working on an introductory manuscript about block designs. So course material will be backed by a variety of sources. I will keep you informed about particular sections that I recommend for each topic. Electronic versions of this syllabus contain links to each book, other than the first one. Those books with useful HTML versions contain an additional link.

- Beezer, introductory *Block Designs* manuscript, to be provided

- Keller and Trotter, Applied Combinatorics [HTML]

- Levin, Discrete Mathematics: An Open Introduction [HTML]

- Guichard, An Introduction to Combinatorics and Graph Theory [HTML]

- Doerr and Levasseur, Applied Discrete Structures [HTML]

- Bogart, Combinatorics Through Guided Discovery [HTML]

- Cusack, Active Introduction to Discrete Mathematics and Algorithms

- Smid, Discrete Structures for Computer Science

- Bondy and Murty, Graph Theory With Applications

Course Web Page   Off of buzzard.ups.edu/courses.html you can find the link to the course web page.

Office Hours   My office is in Thompson 303. Making appointments or simple, **non-mathematical** questions can be handled via email—my address is `beezer@ups.edu`. I rarely do not receive your email, and I read all of my email all of the time, usually very shortly after receiving it. Urgency of replying varies by the hour, day and nature of the message. Office Hours are 10:00–10:50 on Monday and Friday, 8:00–8:20, 10:20–10:50 on Tuesday and Thursday. Office Hours are first-come, first-served, so I do not make appointments for these times, nor do you need to ask me if I will be present at these times. You may assume I will be there, unless I have announced otherwise in class or by email. You **may** make an appointment for other times, or just drop by my office to see if I am in. Office Hours are your opportunity to receive extra help or clarification on material from class, or to discuss any other aspect of the course.

Calendar   The course is organized into four units:

- Basic Counting Techniques (12 lectures)

- Advanced Counting Techniques (12 lectures)

- Graph Theory (11 lectures)

- Block Designs (7 lectures)

Start and stop dates are indicated on the attached tentative calendar.

Computation   Combinatorics (and graph theory), as part of **discrete mathematics**, is a natural area to explore with the aid of computational tools. I have written, and will continue to revise, a small text exclusively about how to use Sage for combinatorial computations. We will not explicitly **require** you to study this material, but will instead suggest that our experience strongly suggests it can be an extremely efficient adjunct to studying the course's topics.

It is easy to use Sage for free at `CoCalc.com`, and a paid account with additional features is very reasonably priced at $14 per month. The Sage Cell Server can be used for quick one-off computations. And if you are comfortable at the command-line, then a local install is easy. The book by Bard is a very helpful general resource for Sage and might be useful for any of your courses.

- Sage Cell Server

- `cocalc.com`

- Beezer, Combinatorial Sage

- Bard, Sage for Undergraduates

- Beezer and Godsil, Explorations in Algebraic Graph Theory with Sage

Practice   Exercises will be suggested regularly as part of each unit. Of course, you are not limited to working **just** these assigned problems and you can find many more in textbooks in the library (ask me for suggestions). We have seven class days reserved for discussions when we can talk about these problems. It is your responsibility to be certain that you are learning from the homework exercises. The best ways to do this are to work the problems diligently, start studying them early, and participate in the classroom discussion. If at this point you are still unsure about a problem, then a visit to my office is in order, since you are obviously not prepared for the examination questions. Making a consistent effort outside of the classroom is the easiest way (only way?) to do well in this course.

> Mathematics not only demands straight thinking, it grants the student the satisfaction of knowing when he [or she] is thinking straight.
>
> —D. Jackson

> Mathematics is not a spectator sport.
>
> —Anonymous

> I hear, I forget. I see, I remember. I do, I understand.
>
> —Chinese Proverb

> An education is not received. It is achieved.
>
> —Anonymous

Examinations   There will be four 50-minute timed examinations. Planned dates are all listed on the **tentative** schedule. The comprehensive final examination will be given at 8 AM on Wednesday, December 15. The final exam cannot be given at any other time, so be certain that you do not make any travel plans that conflict, and also be aware that I will allow you to work longer on the final exam than just the two-hour scheduled block of time.

Grades   Grades will be based on the following breakdown:

- Examinations: 70%

- Final Examination: 30%

Attendance and improvement will be considered for borderline grades, while excessive attendance and late-arrival problems will result in grade penalties. Scores will be posted anonymously on the web at a link off the course page.

Academic Policy Reminders   Here are three reminders about important academic policies which are described thoroughly in the *Academic Handbook*. You can find a link to a PDF version at www.pugetsound.edu/academichandbook, or a printed copy may be requested from the Registrar's Office (basement of Jones Hall).

Registration for Courses of Instruction, Non-Attendance "Regular class attendance is expected of all students. Absence from class for any reason does not excuse the student from completing all course assignments and requirements."

Grade Information and Policy, Withdrawal Grades Withdrawal grades are often misunderstood. A Withdrawal grade (W) can only be given prior to the university deadline listed on our course schedule, and after that time (barring unusual circumstances), the appropriate grade is a Withdrawal Failing (WF), **even if your work has been of passing quality**. See the attached schedule for the last day to drop with an automatic 'W'.

Academic Integrity All of your graded work is expected to be ***entirely*** your own work. Anything to the contrary is a violation of the university's comprehensive policy on Academic Integrity (cheating and plagiarism). Discovered incidents will be handled strictly, in accordance with this policy. Penalties can include failing the course and range up to being expelled from the university.

Purpose   At this point in your college career, you should be well on your way to being an independent scholar, who appreciates the beauty of mathematics and understands the effort needed to master new and difficult ideas. Consistent with that, I will be giving you more freedom than usual to learn this material in a manner that suits you. Of course, with freedom comes responsibility.

Study the material before the lectures, work the exercises early and diligently, tidy up your class notes each evening, and ask questions. Arriving late to class, or having conversations with others during class, not only disrupts your peers, but tells me you are not serious about your education.

Combinatorics is important for many problems in computer science and allied fields (like cryptology), is fundamentally the main part of simple probability questions, and is

useful in other fields of mathematics, such as abstract algebra. Many optimization questions (scheduling, vehicle routing, etc.) rely heavily on ideas from combinatorics. Its also a major component of problems classified as recreational mathematics (puzzles and games).

Conduct   Daily attendance is required, expected, and overall a pretty good idea. Class will begin on-time, so be here, settled-in and ready to go. In other words, walking in the door at the exact time class is to begin is not considered arriving on-time. Repeated tardieness and absences will result in grade penalties, in accordance with university policies. Do not leave class during the lecture unless your continued presence would be a greater interuption — fill your water bottles, use the toilet, and so on, **in advance**. I do not care how much food or drink you bring to class, so long as it does not distract others or make me hungry. Please do not offer me sweets. Please keep phones in your pocket or bag, unless you are using them to read course material. In short, we are here to learn and discuss mathematics together. It is your responsibility to not distract your peers who are serious about their education or distract me as I endeavor to make the best use of the class time for you and your colleagues.

University Notices   These are two notices the university administration requests we relay to you.

Student Accessibility and Accommodation "If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy Perno, Director of the Office of Accessibility and Accommodation, 105 Howarth, 253.879.3395. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential."

I request that you give me at least two full working days to respond to any requests from this office.

Classroom Emergency Response Guidance Please review university emergency preparedness and response procedures posted at www.pugetsound.edu/emergency/. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g.earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Jan 21 MLK Day	Jan 22 Syllabus Start Unit: Basic Counting	Jan 24	Jan 25
Jan 28	Jan 29	Jan 31	Feb 1 Discussion
Feb 4 Last Day to Drop without Record	Feb 5 Snow Day	Feb 7	Feb 8
Feb 11 Snow Day	Feb 12 Snow Day	Feb 14	Feb 15
Feb 18	Feb 19 Discussion	Feb 21 Exam 1 Basic Counting	Feb 22 Start Unit: Advanced Counting
Feb 25	Feb 26	Feb 28	Mar 1
Mar 4 Discussion	Mar 5	Mar 7	Mar 8
Mar 11	Mar 12	Mar 14 Discussion	Mar 15 Exam 2 Advanced Counting

Mid-Term

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Mar 25 Start Unit: Graph Theory	Mar 26	Mar 28	Mar 29 `OKC`
Apr 1	Apr 2	Apr 4	Apr 5 Discussion Last Day to Drop with 'W'
Apr 8	Apr 9	Apr 11	Apr 12 `PDX`
Apr 15	Apr 16	Apr 18 Discussion	Apr 19 Exam 3 Graph Theory
Apr 22 Start Unit: Block Designs	Apr 23	Apr 25	Apr 26
Apr 29	Apr 30	May 2	May 3 Discussion
May 6 Exam 4 Block Designs	May 7 Housekeeping	May 9 Reading Period	May 10 Reading Period

Final Examination: Wednesday, May 15, 8 AM