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| Course No. | | Lecture No. | | Course Title (Subtitle) | Topological Combinatorics and Data Analysis | Credit | 3 |
| Representative Instructor | Name | Woong Kook | (post : | Professor |) | Homepage | |
| | E-mail | woongkook@snu.ac.kr | | | | Phone No. | 010-9245-6732 |
| | Office Hour/Place : | TBA/ 27-210 | | | | | |

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| Prerequisite Course | Calculus, Linear Algebra | | | | | | | |
| *1. Purpose of Course | <p>To understand the role of topological methods in combinatorial mathematics and to apply these methods to networks and mathematical data analysis.</p> <p>To this end, we will analyze combinatorial Laplacians in detail and discuss combinatorial Hodge theory as a bridge between topology and combinatorics. Most of the relevant tools and concepts are formulated using matrices and vector spaces.</p> | | | | | | | |
| *2. Materials and Reference | <p>Lecture notes will be provided prior to each class. The following are additional texts for reference depending on the level of mathematical interests.</p> <p>Graph Theory / Combinatorics: Graphs and Matrices by R. Bapat Algebraic Graph Theory by N. Biggs. A Walk through Combinatorics by M. Bona Enumerative Combinatorics I & II by R. Stanley</p> <p>Homology Theory / Algebraic Topology: Lecture Notes on Elementary Topology and Geometry by I. Singer and J. Thorpe Elements of Algebraic Topology by J. Munkres Algebraic Topology by A. Hatcher</p> | | | | | | | |
| *3. Evaluation (%) | Attendance | Assignments | Quiz | Final | Additional Evaluation | Attitude | Other | 합계 |
| | 30 | 40 | 10 | 20 | | | | 100 |
| | Attendance Policy : | | Students who are absent for over 1/3 of the class will receive a grade of 'F' or 'U' for the course. (Exceptions can be made when the cause of absence is deemed unavoidable by the course instructor.) | | | | | |
| | Other Remarks : | | | | | | | |

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| *4. Lecture Plan | | <p>Week 1. Introduction Lecture 1: Overview of the course: the origin of topology and graph theory. Lecture 2: Preliminaries in combinatorics and graphs</p> <p>Week 2. Graphs and matrices Lecture 3: Matrices for graphs and spanning trees Lecture 4: Matrix-tree-theorem and Temperley's theorem (HW 1 due) Lecture 5: Cycle spaces for graphs</p> <p>Week 3. Applications to networks Lecture 6: Kirchhoff's law and discrete Laplace equation Lecture 7: Effective resistance and information centrality (HW 2 due) Lecture 8: Review and Quiz</p> <p>Week 4. Simplicial homology theory Lecture 9: Abstract simplicial complexes Lecture 10: Simplicial homology (HW 3 due) Lecture 11: Topological Data Analysis</p> <p>Week 5. Combinatorial Hodge Theory Lecture 12: Hodge decomposition and the main theorem Lecture 13: Applications of harmonic cycles to networks (HW 4 due) Lecture 14: High-dimensional networks Lecture 15: Review and final exam</p> |
| 5. Additional Notes for Students | | Students taking this course are considered to have made a pledge not to compromise the scholarly integrity as students in examinations, homework assignments and reports, based on their conscience. |
| 6. Assistance for Students with Disabilities | Class | <ul style="list-style-type: none"> ○ Visual Impairment: Make textbooks(digital textbook, braille textbook, enlarged textbook etc.), Allow note takers ○ Physical Disability: Make textbooks (digital textbook), Allow note takers and assistants ○ Hearing Impairment: Allow note takers and translators, Allow lecture recording ○ Health Impairment: Excuse absence due to health problems, Allow note takers ○ Learning Disability: Allow note takers ○ Intellectual Disability / Autism Spectrum Disorder: Allow note takers and mentors |
| | Assignment & Evaluation | <ul style="list-style-type: none"> ○ Visual Impairment / Physical Disability / Hearing Impairment / Health Impairment / Learning Disability: Extend assignment deadlines, Offer alternate assignment submission and response method, Extend testing period, Offer alternate testing method, Offer different testing room ○ Intellectual Disability / Autism Spectrum Disorder: Offer individualized assignments and alternative evaluations |
| | Others | Students who take this course can get appropriate level of support service including the support listed above depending on the students' individual characteristics and needs through consultation with professors and the Support Center for Students with Disabilities. If you have any questions concerning support service for students with disabilities you can contact Professor *** (Contact Information) or Support Center for Students with Disabilities (02-880-8787). |