2024 年度 第1学期　工学部 情報系学科　　日英区分: 英語

グラフ理論
Graph Theory

講義番号	科目区分	学期
093205		第1学期

ナンバリングコード	教室
KAAA0ENIZ2001N	工学部4号館第11講義室

必修・選択の別	メディア授業科目
	ー

単位数	曜日・時限
2	月3〜4,木5〜6

担当教員 (ローマ字表記)

YUCEL ZEYNEP [YUCEL ZEYNEP]

持続可能な開発目標 (SDGs)

対象学生

Faculty of Engineering (2017〜2020) students

他学部学生の履修の可否

対象学生の項目を参照

連絡先

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オフィスアワー

At any time students may contact the instructor, but making an appointment by e-mail is strongly advised.

学部・研究科独自の項目

No items are given.

使用言語

日本語

授業の概要

A graph is a notion abstracted from connection between objects. Graph theory is effectively applied in diverse fields today. In the lecture, students review notions in mathematics first, then are provided talks about paths and cycles, properties of trees, planarity of graphs, coloring, and network flows and connectedness.

学習目的

The lecture aims to make students acquire the ability to apply graph theory to various problems, that is, to convert a practical problem into an abstract problem in graph theory, and to solve the converted problem with knowledge in graph theory.

到達目標

1. To understand the concepts used in graph theory, and to gain the ability to abstract problems of graph theory from actual problems. Those concepts include graphs, vertices, edges, subgraphs, deletion of vertices or edges, contraction of edges, complete graphs, bipartite graphs, walks, trails, paths, closed walks, connected graphs, connected components, disconnecting sets, trees, planar graphs, graph coloring, and directed graphs.

2. To gain the ability to solve problems in graph theory by using known theorems and algorithms.

授業計画

1. Basic mathematical foundations
2. Basic definitions and properties of graphs, Isomorphic graphs
3. Bipartite graph, Complete bipartite graph, Complementary graph of simple graph, Characterization of bipartite graphs,
4. Properties of graphs and shortest path problem, Directed acyclic graph and topological order, Dijkstra method
5. Euler circuit, Characterization of Euler graphs
6. Hamilton graph, Traveling salesman problem
7. Tree and forest, Characterization of trees, Spanning tree, Number of spanning trees of a graph, Matrix-tree theorem
8. Minimum connector problem, Kruskal's Algorithm, Depth-First-Search, Breadth-First-Search (BFS), Complete binary tree
9. Planarity of graphs, Planar graph, Plane graph, Euler's formula
10. Wagner's theorem, Geometric dual, Outer planar graph, Crossing number, Thickness
11. Graph coloring, Vertex coloring problem, Kempe's algorithm
12. Map coloring, DSatur method, Greedy algorithm, Chromatic polynomial
13. Network and flow, Maximum flow-minimum cut, Ford-Fulkerson algorithm
14. Connectivity of graphs, Degree of connectivity, Edge-connectivity, Connectivity of a complete graph, Edge-disjoint and internally disjoint paths

授業時間外の学習(予習・復習)方法(成績評価への反映についても含む)

Reading several next sections of the textbook in advance is encouraged, because it helps students to understand the lecture. Furthermore, sufficient reviews of lessons are desirable. Working on questions set in classes so as to deepen their understanding is especially recommended.

授業形態

(1)授業形態-全授業時間に対する[講義形式]:[講義形式以外]の実施割合

90% : 10%

(2)授業全体中のアクティブ・ラーニング

協働的活動(ペア・グループワーク、ディスカッション、プレゼンテーションなど)

少ない

対話的活動(教員からの問いかけ、質疑応答など)

やや少ない

思考活動(クリティカル・シンキングの実行、問いを立てるなど)

やや少ない

理解の確認・促進(問題演習、小テスト、小レポート、授業の振り返りなど)

やや少ない

(3)授業形態-実践型科目タイプ

該当しない

(4)授業形態-履修者への連絡事項

Students are advised to inform the instructor of requiring excessive teaching format before registration.

使用メディア・機器・人的支援の活用

視聴覚メディア(PowerPointのスライド、CD、DVDなど)

多い

学習管理システム(Moodleなど)

多い

人的支援(ゲストスピーカー、TA、ボランティアなど)

なし

履修者への連絡事項

A slide show prepared by the instructor is the basic way of giving a lecture. A chalk talk is properly done so as to explain an answer of an excerise or to give supplementary explanations to the slide show. An ordinary or wireless microphone is always used. Students are advised to inform the instructor of requiring excessive zooming before registration.

教科書

教科書1	ISBN	9784320123144		
	書名	グラフ理論の基礎と応用		
	著者名	舩曳信生 [ほか] 著		
	出版社	共立出版	出版年	2012

備考

参考書

参考書1	ISBN	9784320014442		
	書名	グラフ理論への入門		
	著者名	J.A. Bondy, U.S.R. Murty著 ; 立花俊一, 奈良知恵, 田澤新成共訳		
	出版社	共立出版	出版年	1991
参考書2	ISBN	9784764902961		
	書名	グラフ理論入門		
	著者名	R.J. ウィルソン著 ; 西関隆夫, 西関裕子共訳		
	出版社	近代科学社	出版年	2001

備考

成績評価基準 (授業評価方法)

Evaluation is made on the basis of short examination and final examination.
It is desirable that students understand lectures sufficiently before each examination.

受講要件

No specific requirement for registration is required.

教職課程該当科目

Type-1 High school teaching license (Information)

JABEEとの関連

No relation to JABEE.

持続可能な開発目標 (SDGs)

(教育)すべての人に包摂的かつ公正な質の高い教育を確保し、生涯学習の機会を促進する。

実務経験のある教員による授業科目

備考/履修上の注意

It is desirable that students have taken courses in linear algebra and analysis in the first year.