

# Course Outline: Math 4022 – Introduction to Graph Theory

**Instructor :** Prasad Tetali, office: Skiles 234, email: tetali@math.gatech.edu  
**Office Hours:** Mon. 1:30 – 3:00 pm, Thurs. Fri. 2:00 – 3:00 pm (tentative)

**Suggested Text books:** (1) *Introduction to Graph Theory*, by Doug West (2nd edition, Prentice-Hall, 2001). (2) *Graph Theory with Applications*, by J.A. Bondy & U.S.R. Murty (North-Holland, 1976.): available for free download on the internet:  
<http://www.ecp6.jussieu.fr/pageperso/bondy/books/gtwa/gtwa.html>

**Syllabus:** Based on material in Chapters 1 – 6. Familiarity with basic material in Chapter 1 will be assumed. Some sections will be omitted (e.g. Sec. 3.3), and time permitting, a couple of sections from other chapters (e.g. Secs. 7.1 and 8.1) in the book will be covered. The emphasis will be on the following Fundamental Theorems and Algorithms.

## Theorems:

- The Matrix-tree theorem
- Hall's matching condition and Tutte's theorem
- Connectivity and Menger's theorems
- Max-flow Min-cut theorem
- Vertex coloring and Brooks' theorem
- Edge coloring and Vizing's theorem
- Planarity and Kuratowski's theorem
- Intro to Extremal graph theory: Turán, Ramsey theorems

## Algorithms:

- Shortest paths algorithm
- Minimum spanning tree algorithms
- Bipartite Matching (the Hungarian algorithm)
- Ford-Fulkerson algorithm

Most topics will be discussed for about a week. Time permitting, rudiments of random graph theory will be covered.

## Course Objective.

- To develop interest in graph theory and its many applications

**General grading policy : Homeworks 20%, Tests 50%, Final exam 30%**

**Test 1: Sept. 19th (Wed.) Test 2: Oct. 22nd (Mon.) Test 3: Nov. 19th (Mon.)**

No make-up tests will be allowed.

Homeworks will be assigned, collected and graded. You are strongly advised to solve all the homework problems; Late submission of HWs is discouraged with a penalty of 20%.

Spring 2007: MATH 4022 (Introduction to Graph Theory) Fall 2007

(Based on the books by Douglas West and Bondy-Murty.) [Click here for an outline](#)

All HW problems are from the book by Douglas West, unless otherwise specified.

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Homework 1 (due : next wednesday, Aug. 29th)

Problems 1.1.12, 1.1.25, 1.1.28, 1.1.30

Problems 1.2.8, 1.2.20, 1.2.27

Optional problems (no need to turn in): Problems 1.1.29, 1.3.41

Homework 2 (due : next wednesday, Sept. 5th)

Problems 1.3.56

Problems 2.1.33, 2.1.37, 2.2.7, 2.2.18 \*

\* 2.2.18 may be hard -- try solving 2.2.17 instead :

consider elementary row operations of adding/subtracting rows...

Homework 3 (NO NEED TO TURN IN)

Section 3.1: Problems 1, 3, 8, 18, 19, 24, 25, 28, 31, 32, 33, 34, 37.

TEST 1 in class on WEDNESDAY, Sept. 19th (OPEN NOTES, CLOSED BOOK)

Here are a couple of old tests.

[Click here for an old Test 1](#)

[Click here for an old Test 2](#)

[Click here for TEST 1](#)

Homework 4 (Due: October 10th)

Section 3.3: Problems 7, 9, 10, 16

Section 4.1: Problems 14, 27, 28 (Optional : 8, 9, 13)

Homework 5 (Due: November 12th)

Section 5.1: Problems 1, 7, 16, 22, 47

Section 5.2: Problems 1, 15, 16, 22

[Click here for TEST 2 \(with solutions\)](#)

TEST 3 on Monday, Nov. 19th (Open Notes): Section 4.3 and Chapter 5 (to the extent covered):

Some practice problems from Sec. 4.3: Problems 5, 6, 10, 12 -- 15 (most were done in class.) \*\*\*

[Click here for TEST 3 \(with solutions\)](#)

\*\* OFFICE HOURS NEXT TWO WEEKS (Nov. 26th onwards) : Mon, Tue, Wed. 1:30-2:30pm

\*\* CLASS on December 3rd will be in SKILES 255 (Guest speaker : Nick Harvey, MIT)

\* FINAL EXAM during 11:30--2:20pm THURSDAY, Dec. 13th\*

\*\* SYLLABUS for the FINAL : \*\*

Sections 2.1-- 2.3, Sections 3.1--3.3

Sections 4.1--4.3, Sections 5.1, 5.2

# Outline: Math 4022 (Fall 08) – Introduction to Graph Theory

**Instructor :** Prasad Tetali, office: Skiles 234, email: tetali@math.gatech.edu

**Office Hours: Mon. Wed. 3:00-4:30pm** (tentative)

## Suggested Textbooks:

- (1) **Introduction to Graph Theory**, by Doug West (2nd edition, Prentice-Hall, 2001).
- (2) *Graph Theory with Applications*, by J.A. Bondy & U.S.R. Murty (North-Holland, 1976.): available for free download on the internet:  
<http://www.ecp6.jussieu.fr/pageperso/bondy/books/gtwa/gtwa.html>

**Syllabus:** Based on material in Chapters 1 – 6 of the first textbook. Familiarity with basic material in Chapter 1 will be assumed. Some sections will be omitted (e.g. Sec. 3.3), and time permitting, a couple of sections from other chapters (e.g. Secs. 7.1 and 8.1) in the book will be covered. The emphasis will be on the following fundamental Theorems and Algorithms.

## Theorems:

- The Matrix-tree theorem
- Hall's matching condition and Tutte's theorem
- Connectivity and Menger's theorems
- Max-flow Min-cut theorem
- Vertex coloring and Brooks' theorem
- Edge coloring and Vizing's theorem (Proof: time permitting)
- Planarity and Kuratowski's theorem (No proof)
- Intro to Extremal graph theory: Mendel, Turán, Ramsey theorems (Only some proofs)

## Algorithms:

- Shortest paths algorithm (Brief review)
- Minimum spanning tree algorithms (Brief review)
- Bipartite Matching (The Hungarian algorithm)
- Ford-Fulkerson algorithm

Most topics will be discussed for about a week. Time permitting, rudiments of random graph theory will be covered.

## Course Objective.

- To develop interest in graph theory and its many applications

**General grading policy :** Homeworks 20%, Tests 40%, Final exam 40%

**Test 1: Sept. 22nd (Mon.)    Test 2: Oct. 31st (Fri.)**

**Final exam:** December 10th (Wed.) 11:30–2:20pm

No make-up tests will be allowed.

Homeworks will be assigned, collected and graded. You are strongly advised to solve all the homework problems; Late submission of HWs is discouraged with a penalty of 20%.

FALL 2008: MATH 4022 (Intro to Graph Theory)

[Click here for an outline](#)

ALL HW PROBLEMS ARE FROM THE BOOK BY Douglas West,  
UNLESS SPECIFIED OTHERWISE:

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HOMEWORK 1 (Due: Wednesday, Sept. 3rd)

Section 1.1: Problems 12, 16, 28, 30

Section 1.2: Problems 20, 25, 27

Section 1.3: Problems 41

Optional Problems (no need to turn in): 1.1.25, 1.1.29, 1.2.8

HOMEWORK 2 (Due: Monday, Sept. 15th)

Section 1.3: Problems 8, 64

Section 2.1: Problems 37

Section 2.2: Problems 1, 9, 10, 17

Section 2.3: Problem 7 (Hint should refer to 2.1.37, and not 2.1.34)

[TEST 1 \(September 22nd\)](#)

First three to be done in class;

the FOURTH to be brought back to CLASS on WEDNESDAY, Sept. 24th

HOMEWORK 3 (Due: Monday, Oct. 6th)

Section 3.1: Problems 3, 28, 33, 37

Section 3.3: Problems 10, 15, 16

HOMEWORK 4 (Due: Monday, Oct. 27th)

Section 4.1: Problems 1, 5, 7, 8, 28

Section 4.2: Problems 1, 8, 24

[TEST 2 \(October 31st\)](#)

First three to be done in class;

the 4th+5th to be brought back to CLASS on Monday, Nov. 3rd

HOMEWORK 5 (Due: Monday, Nov. 24th)

Section 5.1: Problems 1, 4, 28, 38

Section 5.2: Problems 1, 22 \* (see below)

Section 5.3: Problems 1, 8

Extra Problem: An  $n$ -set is monochromatic, if every element of the set gets the same color. A collection of  $n$ -sets has Property B, if there exists a 2-coloring (as in a Red-Blue coloring) of the elements so that no set is monochromatic. Show that every collection containing less than  $2^{n-1}$  sets (each being an  $n$ -set) has Property B. (Hint: use a random 2-coloring.)

(\*) Sorry for the typo: the RANGE should be THREE MILES rather than 6 miles; everything else is good.

Use Application 5.2.11 in the book to solve this.

The problem is adapted (as acknowledged in the textbook) from Bondy-Murty, where the city has RADIUS 6 MILES and a range of NINE MILES for each transmitting station.

\*\*\* FINAL EXAM on Wednesday, Dec. 10th, 11:30am -- 2:20pm (Room 246)

Syllabus: Chapters 1-- 5 of Doug West's book.

OPEN TEXT BOOK \*\*\*

## Math 4022 (Introduction to Graph Theory) Fall '10

- **Instructor:** Asaf Shapira
- **Time/Location:** Howey (Physics) S204, Tuesday/Thursday 13:30-15:00
- **Office hour and location:** Skiles 262. Please schedule with me.
- **Contact info:** asafico@math.gatech.edu
- **Prerequisites:** MATH 3012 or equivalent

### Suggested Reading:

- *Graph Theory*, by R. Diestel (3<sup>rd</sup> edition, Springer). Free electronic version available at <http://diestel-graph-theory.com>
- *Introduction to Graph Theory*, by Doug West (2<sup>nd</sup> edition, Prentice-Hall, 2001).
- *Graph Theory with Applications*, by J.A. Bondy and U.S.R. Murty (North-Holland, 1976): available for free download at <http://www.ecp6.jussieu.fr/pageperso/bondy/books/gtwa/gtwa.html>

**Course Objective:** To develop interest in graph theory and its many applications

**General grading policy : Homeworks 40%, Final Exam 60%. You must pass the final exam!**

Homeworks will be assigned, collected and graded on a regular basis. You are strongly advised to (attempt to) solve all the homework problems. You are allowed to discuss your homework assignments with other students, but you are required to write the solutions on your own. In other words, you are **not** allowed to copy another student's solution.

**Late submission of HWs is discouraged with a penalty of 20%.**

### Suggestions:

- Please feel free to ask questions at any time: before, after or during the class.
- Please make use of my office hours.
- Class participation and discussion is highly encouraged.

**Academic Dishonesty:** All students are expected to comply with the Georgia Tech Honor Code. Any evidence of cheating or other violations of the Georgia Tech Honor Code will be submitted directly to the Dean of Students. The institute honor code is available at <http://www.deanofstudents.gatech.edu/Honor/honorcode.txt>