Research Topics in Graph Databases (CPT-S 580-08, 2015 Spring)
TU,TH 16.15-17.30
Course id: 7976

Instructor: Yinghui Wu
Office: EME 49
Email: yinghui@eecs.wsu.edu
Web: http://eecs.wsu.edu/~yinghui/

Description: Graphs are everywhere: social networks (Facebook, Twitter), knowledge graphs (Google), cyber networks (Data centers) and biochemical networks. This course covers basic technology and advanced research topics in connection with large-scale graph data management and graph querying, from “big data” perspective.

1. Basic technology
   - Basics on relational databases, XML and semi-structured data
   - Graph databases: storage, indexing and graph views
   - Graph querying: query languages and algorithms

2. Advanced topics
   - Querying big graph data: making queries feasible on big graphs.
   - MapReduce and distributed graph query evaluation

Prerequisites: There is no formal prerequisite. Some background in relational databases and graph theory is necessary. Basic knowledge of computational theory and reasonable experience in coding are expected for course projects.

Course format: This is a seminar course. Lectures are to provide background as needed. Students will be expected to read related research papers or textbook on a provided list. Each student will also be expected to complete and present either a survey or a course project independently.

Grading: In keeping the research seminar nature of the course, there will be no exams. Instead, students are required to read research papers, write reviews, complete a course project and present the project in class. Final grades will be determined as follows:
- Reviews: 40%
- Project: 45%
- Project report and presentation: 15%

Review: You should read as many papers on a provided list as possible. You should also select 8 papers from the list, and write reviews for those papers. Each review should be about one-page long, and should consist of a compelling mix of summary, key ideas and contributions, motivation for studying the problems, criteria for the line of research, evaluation, and possible extensions.

Project: Projects will be developed during the class. A project requires (a) design and development of an algorithm that deals in more depth with a topic encountered during the semester, or (b) a comprehensive survey of a line of research. You are expected to complete a project independently, and write and present a final project report.
Algorithm Design Topics: You may take any topic from a given list, and are encouraged to come up with your own. The same project may be taken by multiple people, but must be done separately. Some topics are given below.
- Develop or implement a centralized, distributed or MapReduce algorithm for one of the following problems below. Each problem accounts for a project.
  a) Reachability: given a graph G and a pair (s, t) of nodes in G, determine whether s can reach t in G, i.e., whether there exists a path from s to t.
  b) All-pair distances. Given a graph G, compute the distance from s to t for all pairs of nodes (s, t) in G. Here by distance from s to t we mean the length of a shortest path from s to t in G.
  c) Subgraph isomorphism. Given a distributed graph G and a graph pattern Q, find all subgraphs of G that are isomorphic to Q.

Survey Topics: For final survey, pick any of the topics from a list below, and write a comprehensive survey on the topic.
2. Distributed graph search engines with applications.
5. MapReduce algorithms for querying graphs.

Note: You may come up with your own project topics and proceed with the permission of the instructor. The proposed topic must be closely related with the course topics.

References: There is no textbook for the course. The readings and related resources will be provided by the week in which they will be discussed. As optional references for background, Graph Theory by Reinhard Diestel is recommended. For computational complexity, Computers and Intractability: A Guide to the Theory of NP-Completeness by Garey and Johnson is recommended.

Policies

Missing or late work
Except by prior arrangement, missing or late work will be counted as a zero.

Collaboration
Exploratory collaboration on assignments is allowed (and the final submissions must contain a list of all collaborators). However, students must prepare solutions individually. As an example of the ideal scenario, the following situation is permissible:

A group of students meets to develop the solution to a problem on a white board. Each student records individual notes from this problem solving meeting. All students then prepare solutions individually and without further collaboration. These solutions show the names of all members in the initial group.

Examples of collaborations that are not allowed include, but are not limited to:
- Sharing pieces of any written solution
- Sharing source code or any other computer programs
• Reviewing final written solutions

Collaboration on the projects must be discussed with the instructor.

**Academic Integrity**

Any student who violates the University's standard of conduct relating to academic integrity will be referred to the Office of Student Conduct and may fail the assignment or the course. You can learn more about Academic Integrity on the WSU campus at [http://conduct.wsu.edu](http://conduct.wsu.edu). Please also read this link carefully: [EECS Academic Integrity Policy](http://conduct.wsu.edu). Please use these resources to ensure that you do not inadvertently violate WSU's standard of conduct.

**Safety on Campus**

Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan ([http://safetyplan.wsu.edu/](http://safetyplan.wsu.edu/)) and visit the Office of Emergency Management web site ([http://oem.wsu.edu/](http://oem.wsu.edu/)) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.

**Students with Disabilities**

Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.

**Weather Policy**

For emergency weather closure policy, consult: [http://alert.wsu.edu](http://alert.wsu.edu).

**Changes**

This syllabus is subject to change. Updates will be posted on the course website.