COMP9312
Revision & Final Exam

COMP9312_23T2

UNSW
SYDNEY

Syllabus Review for Graph Algorithms

- Basic data structure to store graphs

  - Advantages/disadvantages of each data structure

- Graph Traversal

  - BFS, DFS, online reachability, connected component detection, topological sort, minimum spanning tree (Prim, Kruskal),

- Reachability

  - Transitive closure, tree cover, two-hop cover

- Path

  - Dijkstra's algorithm, A* search, all-pairs shortest distance/path

Syllabus Review for Graph Algorithms (Cont)

- Cohesive subgraph detection

  - K-core, k-truss, triangle counting

- Distributed graph processing

  - Mapreduce vs Pregel (why we need graph distributed system), Pregel, Distributed core decomposition, Distributed Connected Component Detection, RDBMS vs Graph Database (why we need graph database)

RESEARCH ON GRAPH:

REAL DATA

- 🏷️ Money Transactions
- 🧬 Protein Interactions
- 🌐 Internet   ⬛ System
- 💗 Medical Records
- 📞 Phone Calls
- 🗺️ Road Map
- @ Social Network

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GRAPH MODEL

- Traditional Graph
- Streaming Graph
- Heterogeneous Graph
- Knowledge Graph
- Attributed Graph
- Temporal Graph
- Evolving Graph
- Uncertain Graph

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GRAPH PROBLEM

Link Analysis (relevance) Pagerank
SimRank   Link Prediction   Clustering

Degree/Neighbors (structural)
Cluster Coefficient   Triangle   Vertex Cover

Distance/Path (reachability) Reachability
Shortest Path   Spanning Tree   Steiner Tree
K-Hop   Centrality   KNN   Keyword Search

Subgraph Detection Graph Similarity
Cohesive Subgraph   Subgraph Enumeration

Propagation Influence Maximization
Information Cascade   Label Propagation

Node mapping (Embedding)
Node2Vec   AI4DB

Graph Analytics System

Graph Database

APPLICATION

- Recommendation
- Anomaly Detection
- Visualization
- Cybersecurity
- Fraud Detection
- Marketing
- Legal Reasoning
- Promotion
- Traffic Monitoring
- Virus Control

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Learning outcome

We did not introduce too many algorithms in COMP9312, but there are some implementation details you need to consider even only about graph storage and very fundamental algorithms like connected component detection.

Depth ←————————————→ Breath

When you implement some ideas in the future, whatever programming language you use, think about how we optimize the algorithm. When designing and implementing algorithms, one small step forward may significantly improve efficiency and reduce space usage.

Topic Review for Graph Learning

- Graph Node Feature Engineering

  - Node level/ Edge level feature options

- Node Embedding

  - Encoder/ Decoder framework

- Graph Neural Network

  - GCN, GraphSage, GAT

  - Train GNNs

Final Exam Key Details

- Online exam

- 2pm – 5pm (Sydney time) 22th August 2023 (Tuesday)

- Submit answers via Moodle

- Can submit answers multiple times

- Can submit answers any time

- Do not leave submission until the last minute

- UNSW will not accept any special consideration claims from people who already attempted the exam

Final Exam Key Details (Cont)

- 8 questions (1—2 GNN questions)

- No need to write python code.

- Include several algorithm design questions.

  - Use learned techniques to solve new problems

  - Analyze performance (time complexity, space complexity)

- Plagiarism checking will be applied

Supplementary Exams

Supplementary Exams are only available to people who are absent from the Final Exam with **good** reason

(good = documented, serious, clearly affects ability to do exam)

If you are awarded a Supp Exam ..

- You must make yourself available for it

- Non-attendance at the Supp => mark of 0 for the exam

Ask us anything

- Forum
- Email
- Private Consultation booking by email

Assessment Summary

```
ass1    = mark for assignment 1 (out of 15)
ass2    = mark for assignment 2 (out of 10)
Project = mark for project (out of 25)
Exam    = mark for final exam (out of 50)


final_mark  = ass1 + ass2 + project + exam
Grade       = HD|DN|CR|PS if final_mark >= 50
            = FL if mark < 50
```

Assessment

Assessment is about determining how well you understand the syllabus of this course.

If you can't demonstrate your understanding, you won't pass.

In particular, we don't pass people just because ...

- please, please, ... my parents will be ashamed of me
- please, please, ... I tried *really hard* in this course
- please, please, ... this is my final course to graduate
- please, please, ... I'll be excluded if I fail COMP9312
- etc. etc. etc.

Assessment (Cont)

Of course, assessment isn't a "one-way street" ...

• I get to assess you in the final exam

• you get to assess me in the Course Evaluation

MyExperience evaluations are online (via MyUNSW) NOW

• Telling us good things is ok.

• Telling us things to improve is very useful.

Beyond this course

Data Structure & Programming & Graph Theory

No single correct answer. (Think about our project questions.)

Take pride in your work. (Aim for quality, not just correctness)

PhD scholarships are available, welcome to apply HDR positions if you are interested in this course.

That's all folks!

Good luck with the exams ... and life ...

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