Debojjal Bagchi

1st Year M.S. Studnet
The University of Texas at Austin
Email : debojjalb@utexas.edu
Linkedin : linkedin.com/in/debojjal-bagchi

Academic Qualifications

Master of Science in Engineerng (Thesis) 2023-Present
The University of Texas at Austin
Major: Transportation Engineering, *Minor:* Operations Research & Industrial Engineering
CGPA : 4.00 / 4.00

Bachelor of Science (Research) 2019-2023
Indian Institute of Science, Bengaluru
Major: Earth & Environmental Science, *Minor:* Mathematics
CGPA : 8.7/10 (*Major CGPA*: 9.4/10)
Thesis: Algorithms for Bi-Criterion Asymmetric Steiner Travelling Salesman Problem (Ongoing)

All India Senior School Certificate Examination (AISSCE) April, 2019
Central Board of Secondary Education (CBSE)
Aggregate Score : 96%

All India Secondary School Examination (AISSE) April, 2017
Central Board of Secondary Education (CBSE)
CGPA : 10/10

Conference Presentations

- **Debojjal Bagchi**, Prateek Agarwal, Tarun Rambha, Venktesh Pandey. (2023, January). *A Local Search Heuristic for Bi-criterion Steiner Travelling Salesman Problem*, **TRB Annual Meeting 2023**, Washington, D.C., USA. [**Poster**]
- **Debojjal Bagchi**, Prateek Agarwal, Tarun Rambha, Venktesh Pandey. (2022, October). *A Local Search Heuristic for Bi-criterion Steiner Travelling Salesman Problem*, **INFORMS Annual Meeting 2022**, Indianapolis, USA. [**Abstract**] [**Presentation**]

Technical Skills

- **Programming Languages:** C, Python, GAUSS
- **Software and Libraries:** CPLEX, GAMS, OR-Tools, OSMnx (OpenStreetMap), NetworkX, TensorFlow, Pandas, NumPy, Scikit-learn, Matplotlib, Plotly, Streamlit, SciDavis, MS Office, LaTeX, GitHub

Research Experience

An Adaptive Large Neighbourhood Search Heuristics for Reverse Logistic Network Design (*May'22- Aug'22*)
Guide: Prof. Amina Lamghari ***Université du Québec à Trois-Rivières, Québec, Canada***

- Performed an extensive literature review of heuristics for **Reverse Logistics (RL) network design** problems including **Tabu-Search, Simulated Annealing** and **Bee Colony Optimisation**.
- Developed a **Scenario-based Mixed Integer Linear Program** (MILP) formulation for the RL network design problem **under uncertainties** for wood industries of Quebec.
- Developed an **Adaptive Large Neighbourhood Search (ALNS)** heuristic for the RL network design problem and introduced the concept of **adaptive neighbourhoods**.
- Solved the MILP using **CPLEX** and implemented the ALNS heuristic on Python.
- Currently performing several **bench-marking tests** to compare the time constrained solutions of MILP formulation to the ALNS heuristic.

A Local Search Heuristics for the Multi-objective Steiner Travelling Salesman Problem (*July'21- Ongoing*)
Guide: Prof. Tarun Rambha ***Indian Institute of Science, Bengaluru, India***

- Performed extensive **literature review** of existing heuristic algorithms for the Travelling Salesman Problem, including Pareto Local Searches, Lin-Kernighan Heuristic, & r-opt.
- Formulated a **scalerisation based Integer Program (IP)** for the MOSTSP & implemented it using **CPLEX**.
- **Developed & implemented two brute-force exact methods** for the Multi-Objective Steiner Travelling Salesman Problem (MOSTSP).
- Successfully **developed & implemented a new local search heuristic** for the MOSTSP based on a **proposed Multi Objective 3-opt neighbourhood** that **performs better than CPLEX solutions to the IP formulation for fixed computational budget.**
- More details about the work can be found at this google drive link. The work was presented at **INFORMS Annual Meeting** & is accepted for presentation at **TRB Annual Meeting**. Aim to publish the findings by January 2023.

Implemented an Algorithm for the Reliable Facility Location Problem (RFLP) (*Sep'20- Dec'20*)
Guide: Prof. Megha Sharma ***Indian Institute of Management, Calcutta, India***

- Got an in-depth understanding of the Facility Location Problem.
- **Successfully implemented** an approximation algorithm with uniform failure probabilities for the Reliable Facility Location Problem (RFLP) based on Shen et al., 2010
- Understood the fundamentals of heuristics.

Short Term Projects

Portfolio Optimization [GitHub Rep] [Project Report Presentation] **Guide: Prof. Sashi Jain**, (IISc, Bengaluru)

- Implemented **Markowitz Portfolio Optimization using Quadratic Programming & Monte Carlo Method**.
- Computed the **Minimum Variance Portfolio** (MVP), **Maximum Sharpe Portfolio**, plotted the **Efficiency Frontier**, calculated **Portfolio Beta** (for MVP) & compared with **Security Market Line**.
- Compared results between the two methods.

Traffic Equilibria [GitHub Rep] [Abridged Results PDF] **Guide: Prof. Tarun Rambha** (IISc, Bengaluru)

- Implemented the **Method of Successive Averages (MSA)** algorithm for computing traffic equilibria in real transportation network in a **time & space efficient** way on python.
- Computed **User Equilibrium (UE)** & **System Optimum (SO)** along with the **Total System Travel Time** for both UE & SO problems.
- Compared the run times for the MSA algorithm based on **Label Correcting** & **Label Setting** shortest path algorithms.

Scholastic Achievements

- **Mitacs Globalink Research Internship** award for carrying out 12 weeks of research in Canada
- Kishore Vaigyanik Protsahan Yojana **(KVPY) Fellow**
- National Talent Scholarship **(NTSE) Scholar (State Rank 13)**
- Jagadis Bose National Talent Search **(JBNSTS) Fellow**
- **Awarded Certificate of Merit from IIT Guwahati** for completing a course & project on Data Analytics
- **Among top 0.1%** in **Joint Entrance Examination (Main) out of 1.5 million candidates**
- **Among top 1%** in **Joint Entrance Examination (Advanced) out of 1.2 lakh candidates**
- Awarded **"Special Honor"** in category "Academic excellence by a student" in **The Telegraph School Awards**
- **All India Rank 40** in National Creativity Aptitude Test (NCAT), 2020
- **Letter from Central Board of Secondary Education** (CBSE) for outstanding performance in Class 10th

Selected Course Presentations

- Integer Programming Formulation for Steiner Travelling Salesman Problem [Presentation]
- Environment Impact Assessment [Presentation] [Video]
- Traffic Demand Modelling [Presentation] [Video]

Relevant Courses *(Undergraduate level courses are * marked)*

Computer Science:

- Algorithms & Programming *
- Optimisation Methods
- Introduction to Computing for AI & ML
- Game Theory

Mathematics:

- Linear Algebra
- Real Analysis
- Algebra
- Algebraic Structures
- Probability & Statistics *

Civil & Environmental Engineering:

- Public Transportation System Planning
- Traffic Network Equilibrium
- Linear Regression and Discrete Choice Modelling
- Environmental Design *
- Introduction to Satellite Geodesy

Management:

- Behavioural Science
- Finance & Accounts

Industrial Engineering & Operations Research:

- Linear Programming

Leadership Roles & Co-Curricular Activities

- Co-founded CoachIO, an ed-tech startup to provide affordable bootcamp courses to KVPY and olympiad aspirants across India. Managed a team of 9 members.
- Co-ordinated Quadspark, a national level quiz competition as a part of Pravega, the annual science fest of IISc, Bengaluru. The event witnessed 1200+ participants and was held in 3 stages.
- Content creator on personal YouTube channel Debojjal Bagchi. The channel currently has over 10k subscribers and 1M+ views.
- Can play guitar and keyboard. Diploma in Spanish guitar from Nikhil Bharat Sangeet Kala Samiti.
- Passionate about chess.