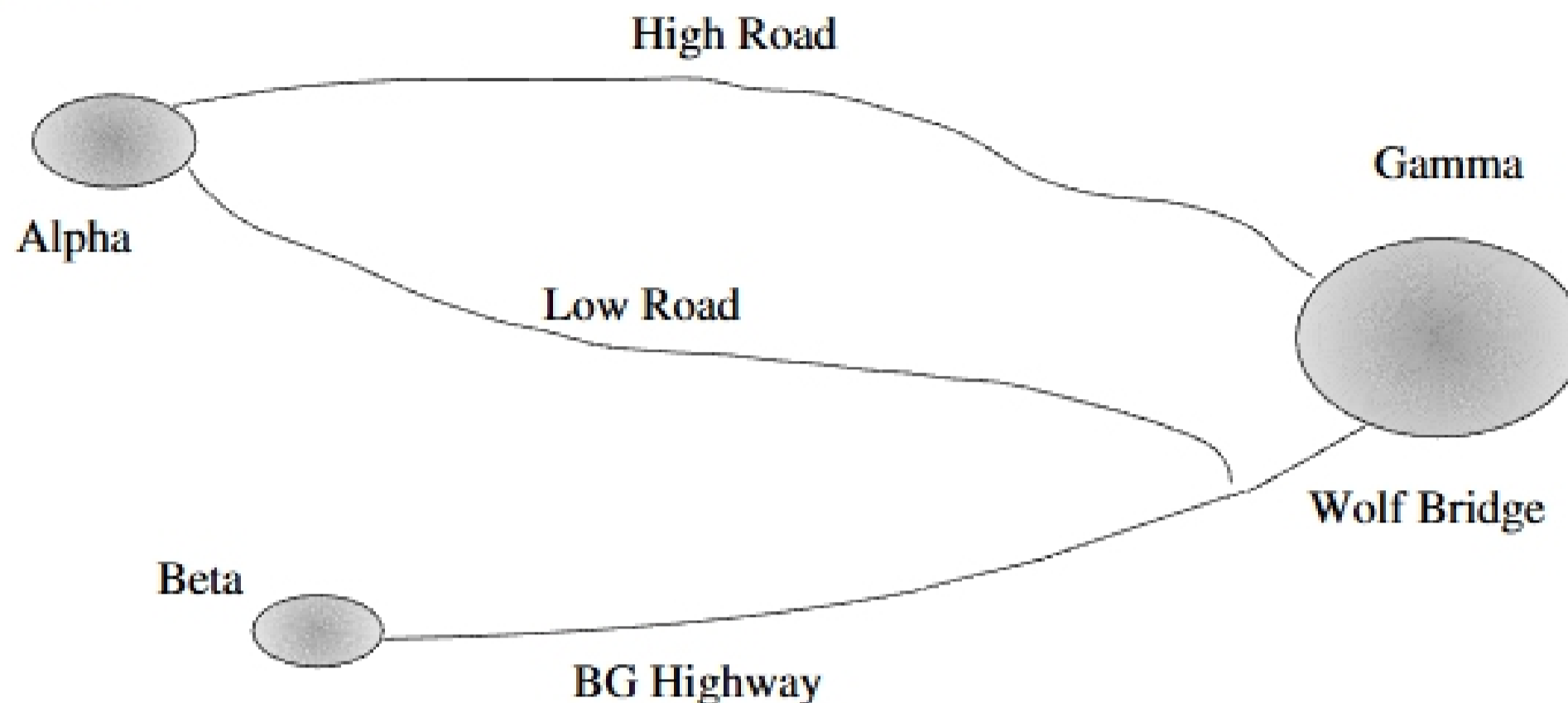


Project #2

Due Date: Wednesday, October 1

The workers in two suburbs Alpha and Beta commute to and from work each day to a nearby city, Gamma.



The local map is given above. One important feature of the local road network is that the Wolf Bridge is unsuitable for truck traffic. Area residents feel that this has contributed to the traffic jams that they experience each morning.

Measurements of the road network tell us the following.

- During morning rush hour 1000 cars leave Alpha each minute for Gamma.
- During morning rush hour 300 trucks leave Alpha each minute for Gamma.
- During morning rush hour 1000 cars leave Beta each minute for Gamma.
- High Road has a maximum capacity of 1000 vehicles per minute.
- Wolf Bridge has a maximum capacity of 2000 vehicles per minute.
- Low Road has a maximum capacity of 1600 vehicles per minute.
- BG Highway has a maximum capacity of 1500 vehicles per minute.
- In the absence of other traffic, a vehicle takes 10 minutes to travel the High Road from Alpha to Gamma.
- In the absence of other traffic, a vehicle takes 1 minute to cross Wolf Bridge.
- In the absence of other traffic, a vehicle takes 6 minutes to travel the Low Road from Alpha to Wolf Bridge.
- In the absence of other traffic, a vehicle takes 4 minutes to travel the BG highway from Beta to Wolf Bridge.
- Measurements show us that, right now, it takes residents of Alpha and Beta about twenty minutes to reach their jobs in Gamma.

Construct a model of the traffic patterns for the morning rush hour, and verify that the region's traffic flow is in Wardrop equilibrium. Is traffic on these roads badly congested?

Do not proceed until you have completed this step, and showed your results to the instructor who will verify that you are ready to proceed.

There is a large parcel of undeveloped land near Alpha. One plan is to create a new industrial park, while the second plan calls for mixed development. Your job is to determine the effects that these plans

will have on traffic flow.

1. If the industrial park is created, it will result in an additional 200 trucks per minute heading toward Alpha in the morning. What effect will this have on traffic flow?
2. If the mixed use plan is chosen, this will increase both car and truck traffic between Alpha and Gamma by 20%. What effect will this have on traffic flow?
3. High Road is narrow and dangerous. Local residents have complained that the trucks on that road drive too quickly for safety. Examine the effect of reducing the speed limit on trucks (only) so that trucks will take 15 minutes to traverse High Road rather than the current 10 minutes.
4. The trucking industry feels that, if the speed limit on High Road is reduced, then Wolf Bridge should be strengthened to carry trucks. What effect will this have on traffic flow?

After you have completed this analysis, prepare a report to the government officials of Alpha, Beta, and Gamma that describes the possible scenarios, and makes recommendations.

You will give a 10-minute presentation to these government officials and the rest of the class on Monday, Wednesday, October 1 to discuss your model, and its results.

Rules:

- The assignment is due at the beginning of class on Wednesday, October 1, 2003.
- This project is to be completed by teams of 2–4 students, and all students shall make a reasonable contribution to the solution of the problem. Separate from the assignment, each student shall hand in a sheet that describes the work of the group. This will be used in grading; students in the same group may receive different grades.
- You may not discuss this project with other members of class, or with anyone outside of class. You may (only) discuss the project with the instructor.
- Aside from the restrictions in above, the use of outside references is acceptable, and indeed encouraged. However, all outside references need to be properly acknowledged.
- The report should be a well-written paper that describes the problem and the solution. All of the usual rules of English grammar and composition apply.
- Papers need to be neat, clean, and paper-clipped or stapled. They do not need to be typed or written in ink, but they must be legible and easily readable.
- Copying the work of another student or portions of a published work constitutes plagiarism. Plagiarism or any other form of academic dishonesty will be cause for immediate failure of the course.

Grading Criteria

Your paper will be graded on the following criteria:

- How reasonable is the model?
- Were all the assumptions made in the model explained? Were they justified?
- How closely are the parameters in the model tied to data?
- How well were the questions answered?
- How good was the error analysis?
- Was the paper well-written?