

Due 23 April 2008 — Project will not be accepted after this date!

Choose your fate. The other option may be completed as extra credit, however you must clearly label which is being submitted as your project and which is being submitted as extra credit. Remember that these are writing projects! A precise description of the problem you are solving should be included in your introduction. Projects should be typed, well written, and solutions should be completely explained. Graphs and diagrams should be drawn in by hand but must be done neatly.

Option 1: Course Scheduling

You are hired to design the algorithms for a course scheduling software package. As case study, schedule the courses for a hypothetical college student, Bob, who plans to graduate with a degree in Basket Weaving with a minor in Rodeo Clowning. Assume that Bob will take the following courses.

General Requirements

| Course | Prerequisites |
|--------|---------------|
| A111 | |
| E101 | |
| G101 | |
| G102 | G101 |
| H101 | |
| H201 | H101 |
| M174 | |
| P103 | |
| P125 | |
| W131 | |
| W231 | W131 |

Minor Requirements

| Course | Prerequisites |
|--------|---------------|
| R221 | B215 |
| R222 | R221, B216 |
| C101 | |
| C201 | C101 |
| C243 | C201 |
| C311 | C243, C335 |
| C335 | C201 |
| C431 | C311 |

Major Requirements

| Course | Prerequisites |
|--------|---------------------------|
| B215 | |
| B216 | B215 |
| B301 | B215 |
| B311 | B216 |
| B343 | B216 |
| B347 | B216 |
| B403 | B347 |
| B413 | B347 |
| B420 | B347 |
| B447 | B301 |
| B463 | B311 |
| B466 | B463 |
| B471 | B301, B311, C101, B343 |

Develop a simple mechanism for creating a preference list that can be applied to any students (not just Bob). Clearly describe how your rule works using Bob’s classes as an example. Keep in mind that the preference list should not depend on the prerequisites or order-requirement directed graph.

Draw the order-requirement directed graph of Bob’s course requirements.

Using your preference list and the order-requirement graph, schedule Bob’s courses using both the list-processing algorithm and the critical path algorithm. Assume that Bob can take up to 4 courses each semester, that each course lasts a single semester, and that Bob does not need to worry about whether a given course will be offered in any particular semester.

If either of Bob’s schedules require that he stay in college for more than 5 years (10 semesters) modify your priority rule so that both algorithms produce a schedule that allows Bob to graduate in at most 5 years. In your report compare the schedules derived from each of the algorithms. Explain how your preference rule affected Bob’s schedule as well as the strengths and weaknesses of your preference rule.

Option 2: Delivery Routes

You have been hired by Martin's Super Market to optimize their delivery route. They would like for a single truck to be able to leave from the warehouse on Cotter Street, make deliveries to the following stores,¹ then return to the warehouse.

Warehouse: 760 Cotter St, South Bend, IN
4401 W Western Ave, South Bend, IN
1302 Elwood Ave, South Bend, IN
2081 South Bend Ave, South Bend, IN
7355 Heritage Square Dr., Granger, IN
314 N Ironwood Dr, Mishawaka, IN
306 N Bittersweet Rd, Mishawaka, IN
926 Erskine plz, South Bend, IN

Make realistic estimates² for the distance (or time if you prefer — since not all roads are equally fast) between each of these locations (28 pairings!). Using your values, draw a weighted graph and try to compute a minimal cost Hamiltonian circuit using the nearest neighbor algorithm starting from each of the locations then using the sorted edges algorithm.

In your report explain how you made your distance estimates. Include an explanation of the algorithms used and your estimate for the minimal time and distance required for a full delivery route (assume that it takes 10 minutes to unload the truck at each stop). If you describe only the optimal circuit in your report be sure to attach a (neat) description of the other routes and their lengths in an appendix.

Hint: Make sure that your distance (or time) measurements are sufficiently precise that you do not have a large number of edges with the same length.

¹Performing a google maps search for “Martin's Super Market near Mishawaka, IN” gave me a nice map of the region. I've posted a cleaned-up PDF of this map on the course webpage.

²Follow roads that actually appear on the map. One popular method for coming up with accurate measurements include measuring roads with a ruler then converting inches to miles using the scale on the map. Another popular method is using mapquest or google maps to find a distance and time estimate between each pair of sites.