Instructions: Do not open until the exam starts. The exam will run for 45 minutes. The problems are roughly sorted in increasing order of difficulty. Answer all questions completely (though pay attention to exactly what the question is asking for). You are free to make use of any result in the textbook or proved in class. You may use up to 6 1-sided pages of notes, and may not use the textbook nor any electronic aids. Write your solutions in the space provided, the pages at the end of this handout, or on the scratch paper provided (be sure to label it with your name). If you have solutions written anywhere other than the provided space be sure to indicate where they are to be found.

If the problem asks for an algorithm, giving a correct algorithm with worse runtime efficiency than what is asked for will be awarded partial credit.

Name:

ID Number:

Seat:

<table>
<thead>
<tr>
<th>Problem</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 1 (Shortest Paths, 30 points). Compute the lengths of the shortest paths from A to each other vertex in the following weighted graph:
**Question 3** (Around the World, 35 points). *Around the World Airlines is offering a deal on trips around the world. The rules are that you can take any series of flights, but that each must travel only Westward (in addition to North and South) and the route must end in your starting city having travelled around the world exactly once. Roxy is considering taking them up on this offer. She has a map of all the cities that are covered by airline, and all of the flights between them that would be allowed as part of this deal. To each flight there is an associated cost, but to each city Roxy associates a value to going there. Devise an algorithm to determine if there is some allowable flightplan for Roxy, starting and ending at some city \$s\$, where the total value of all cities she visits exceeds the total cost of all of the flights she takes.

For full credit, your algorithm should run in time proportional to the total number of cities plus the total number of possible flights.*