**Question 5**

Behold the following graph with source S and sink T.

![Graph Image]

**Part A:** What is the maximum flow of this graph?

**Part B:** What edges compose a minimum cut of this graph?

**Part C:** Using the Edmonds-Karp algorithm, what are the augmenting paths to find the maximum flow? If there are multiple alternatives, just show a legal one.

**Part D:** Draw the final flow graph that results when the Edmonds-Karp algorithm is used to find the maximum flow. If there can be more than one final flow graph, just draw one.

I have included an answer sheet for you to hand in your final answer, and some work sheets for your intermediate calculations. Just hand in the final answer. I don't want to see your work.

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**Question 6**

A number is "righteous" if it fits the following definition:

- 1, 2, 3 and 4 are righteous numbers.
- Suppose i is a d digit righteous number whose last digit is l. Let k equal l+3. If k < 10, then (i*10 + k) is a righteous number.
- Suppose i is a d digit righteous number whose last digit is l. Let m equal l-2. If m != 0, then (i*10 + m) is a righteous number.

So, 20, 142, and 4758 are all righteous numbers. 5, 41 and 470 are not.

Write a program `righteous.cpp` that takes one command line argument n and prints out the number of righteous numbers that have exactly n digits.

The running time of this should be $O(n)$. Use dynamic programming, either with memoization or without recursion. I did both, and I think that doing it without recursion is easier. Hint: how can you use `cache[d][l]`, where d is the number of digits and l is the last digit?

You may assume that n is less than or equal to 40. The following table computes righteous for i between 1 and 10:

<table>
<thead>
<tr>
<th>n</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>righteous</td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>18</td>
<td>28</td>
<td>46</td>
<td>71</td>
<td>112</td>
<td>178</td>
<td>278</td>
</tr>
</tbody>
</table>