Activity: Prime Path Coverage

CS 4501 / 6501 Software Testing
Prime Paths and Simple Paths

Prime path

- Simple path that is **not subpath** of any other simple path

Simple path

- Path that does not have an internal loop
## List Test Requirements for Prime Paths

*Indicate a final node, no more extending*

*Indicate cycle (or loop), no more extending*

<table>
<thead>
<tr>
<th>Start with path of length = 0</th>
<th>Extend path to length = 1</th>
<th>Extend path to length = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>[1, 2]</td>
<td>[1, 2, 3]</td>
</tr>
<tr>
<td>[2]</td>
<td>[1, 3]</td>
<td>[1, 2, 7]</td>
</tr>
<tr>
<td>[3]</td>
<td>[2, 3]</td>
<td>[1, 3, 4]</td>
</tr>
<tr>
<td>[4]</td>
<td>[2, 7]</td>
<td>[1, 3, 5]</td>
</tr>
<tr>
<td>[5]</td>
<td>[3, 4]</td>
<td>[2, 3, 4]</td>
</tr>
<tr>
<td>[6]!</td>
<td>[3, 5]</td>
<td>[2, 3, 5]</td>
</tr>
<tr>
<td>[7]</td>
<td>[4, 3]</td>
<td>[2, 7, 5]</td>
</tr>
<tr>
<td></td>
<td>[4, 5]</td>
<td>[3, 4, 3]*</td>
</tr>
<tr>
<td></td>
<td>[5, 6]!</td>
<td>[3, 4, 5]</td>
</tr>
<tr>
<td></td>
<td>[7, 5]</td>
<td>[3, 5, 6]!</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4, 3, 4]*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4, 3, 5]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4, 5, 6]!</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[7, 5, 6]!</td>
</tr>
</tbody>
</table>
### List Test Requirements for Prime Paths

#### Extended Path to Length = 2
- [1, 2, 3]
- [1, 2, 7]
- [1, 3, 4]
- [1, 3, 5]
- [2, 3, 4]
- [2, 3, 5]
- [2, 7, 5]
- [3, 4, 3]*
- [3, 4, 5]
- [3, 5, 6]!
- [4, 3, 4]*
- [4, 3, 5]
- [4, 5, 6]!
- [7, 5, 6]!

#### Extended Path to Length = 3
- [1, 2, 3, 4]
- [1, 2, 3, 5]
- [1, 2, 7, 5]
- [1, 3, 4, 5]
- [1, 3, 5, 6]!
- [2, 3, 4, 5]
- [2, 3, 5, 6]!
- [2, 7, 5, 6]!
- [3, 4, 5, 6]!
- [3, 4, 5, 6]!
- [4, 3, 5, 6]!

* Indicates a cycle (or loop), no more extending.

Do not include [1, 3, 4, 3] since it is not a simple path and thus is not a prime path.

Do not include [2, 3, 4, 3] since it is not a simple path and thus is not a prime path.
List Test Requirements for Prime Paths

Extend path to length = 3
- [1, 2, 3, 4]
- [1, 2, 3, 5]
- [1, 2, 7, 5]
- [1, 3, 4, 5]
- [1, 3, 5, 6]!
- [2, 3, 4, 5]
- [2, 3, 5, 6]!
- [2, 7, 5, 6]!

Extend path to length = 4
- [1, 2, 3, 4, 5]
- [1, 2, 3, 5, 6]!
- [1, 2, 7, 5, 6]!
- [1, 3, 4, 5, 6]!
- [2, 3, 4, 5, 6]!
- [2, 3, 5, 6]!
- [2, 7, 5, 6]!
- [3, 4, 5, 6]!
- [4, 3, 5, 6]!

Extend path to length = 5
- [1, 2, 3, 4, 5, 6]!

(from previous page)

! Indicate a final node, no more extending

* Indicate cycle (or loop), no more extending
Determine Prime Paths

Consider paths with ! and * (ignore the remaining paths)
Start with the longest path, cross out paths that are its subpaths

Paths in yellow are prime paths

<table>
<thead>
<tr>
<th>[1, 2]</th>
<th>[1, 2, 3]</th>
<th>[1, 2, 3, 4]</th>
<th>[1, 2, 3, 4, 5]</th>
<th>[1, 2, 3, 4, 5, 6]!</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1, 3]</td>
<td>[1, 2, 7]</td>
<td>[1, 2, 3, 5]</td>
<td>[1, 2, 3, 5, 6]!</td>
<td>[1, 2, 3, 5, 6]!</td>
</tr>
<tr>
<td>[2, 3]</td>
<td>[1, 3, 4]</td>
<td>[1, 2, 7, 5]</td>
<td>[1, 2, 7, 5, 6]!</td>
<td>[1, 2, 7, 5, 6]!</td>
</tr>
<tr>
<td>[2, 7]</td>
<td>[1, 3, 5]</td>
<td>[1, 3, 4, 5]</td>
<td>[1, 3, 4, 5, 6]</td>
<td>[1, 3, 4, 5, 6]!</td>
</tr>
<tr>
<td>[3, 4]</td>
<td>[2, 3, 4]</td>
<td>[1, 3, 5, 6]!</td>
<td>[1, 3, 5, 6]!</td>
<td>[1, 3, 5, 6]!</td>
</tr>
<tr>
<td>[3, 5]</td>
<td>[2, 3, 5]</td>
<td>[2, 3, 4, 5]</td>
<td>[2, 3, 4, 5]</td>
<td>[2, 3, 4, 5]</td>
</tr>
<tr>
<td>[4, 3]</td>
<td>[2, 7, 5]</td>
<td>[2, 3, 5, 6]!</td>
<td>[2, 3, 5, 6]!</td>
<td>[2, 3, 5, 6]!</td>
</tr>
<tr>
<td>[4, 5]</td>
<td>[3, 4, 3]*</td>
<td>[2, 7, 5, 6]!</td>
<td>[2, 7, 5, 6]!</td>
<td>[2, 7, 5, 6]!</td>
</tr>
<tr>
<td>[5, 6].</td>
<td>[3, 4, 5]</td>
<td>[3, 4, 5]</td>
<td>[3, 4, 5]</td>
<td>[3, 4, 5]</td>
</tr>
<tr>
<td>[7, 5]</td>
<td>[3, 5, 6]!</td>
<td>[3, 5, 6]!</td>
<td>[3, 5, 6]!</td>
<td>[3, 5, 6]!</td>
</tr>
<tr>
<td>[4, 3, 4]*</td>
<td>[4, 3, 5]</td>
<td>[4, 3, 5]</td>
<td>[4, 3, 5]</td>
<td>[4, 3, 5]</td>
</tr>
</tbody>
</table>
Identify Test Paths

For each prime path, check if it starts with an initial node and ends at a final node. If not, extend the path to start with initial nodes and end at final nodes.

Test paths

- [1, 2, 3, 4, 5, 6]
- [1, 2, 3, 5, 6]
- [1, 2, 7, 5, 6]
- [1, 3, 4, 5, 6]
- [1, 3, 5, 6]
- [1, 3, 4, 3] [4, 3, 5, 6]
- [3, 4, 3] [4, 3, 4]
- [1, 3, 4, 3, 4, 5, 6]

Some test paths can tour multiple test requirements

Already start with initial nodes and end at final nodes. They can already be used as test paths.