Miscellaneous Memory Management topics

Preparing Program for Execution

- Program Transformations
  - Translation (Compilation)
  - Linking
  - Loading

![Diagram showing the steps of translation, linking, loading, and execution](attachment:image.png)
Address Binding

- Assign Physical Addresses = Relocation
- Static binding
  - Programming time
  - Compilation time
  - Linking time
  - Loading time
- Dynamic binding
  - Execution time

Static Address Binding

Static Binding = At Programming, Compilation, Linking, and/or Loading Time
Dynamic Address Binding

Dynamic Binding = At Execution Time

Address Binding

- How to implement dynamic binding
  - Perform for each address at run time:
    \[ pa = address\_map(la) \]
  - Simplest form of `address_map`:
    Relocation Register: \[ pa = la + RR \]
  - More general form:
    Page/Segment Table
Third-chance algorithm

- Second chance algorithm does not distinguish between read and write access
- Write access more expensive
- Give modified pages a third chance:
  - \( u \)-bit set at every reference (read and write)
  - \( w \)-bit set at write reference
  - to select a page, cycle through frames, resetting bits, until \( uw = 00 \):

\[
\begin{array}{rr}
\text{uw} & \text{uw} \\
11 & 01 \\
10 & 00 \\
01 & 00 * \\
00 & \text{(remember modification)} \\
\end{array}
\]

Third-chance algorithm

- Read→10→00→Select
  - Write→11→01→00*→Select

<table>
<thead>
<tr>
<th>...</th>
<th>0</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></td>
<td>c</td>
<td>a*</td>
<td>d</td>
<td>b*</td>
<td>e</td>
<td>b</td>
<td>a*</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td></td>
</tr>
</tbody>
</table>

> a/10 | a/10 > a/11 > a/11 > a/11 a/00* a/00* a/11 a/11 > a/11 a/00*  
> b/10 | b/10 b/10 b/10 b/11 b/00* b/10* b/10* b/10* d/10  
> c/10 | c/10 c/10 c/10 c/10 e/10 e/10 e/10 e/10 e/10 > e/00  
> d/10 | d/10 d/10 d/10 d/10 > d/00 > d/00 > d/00 > d/00 c/10 c/00  

IN | e | c | d |
OUT | c | d | b |