Miscellaneous Memory Management topics

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

Preparing Program for Execution
- Program Transformations
  - Translation (Compilation)
  - Linking
  - Loading

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

**Dynamic Binding = At Execution Time**

<table>
<thead>
<tr>
<th>$i$</th>
<th>$j$</th>
<th>$k$</th>
<th>$l$</th>
<th>$m$</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

- $i$: Index
- $j$: Tag
- $k$: Block Offset
- $l$: Page Offset
- $m$: Page Offset
- $n$: Page Offset

**Function $f$**

- $f(i, j, k, l, m, n)$

- $pa = address_map(la)$

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

<table>
<thead>
<tr>
<th>$uv$</th>
<th>$uw$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0</td>
<td>0 0</td>
</tr>
<tr>
<td>0 1</td>
<td>0 0</td>
</tr>
<tr>
<td>0 0</td>
<td>select</td>
</tr>
</tbody>
</table>

- (remember modification)

### Third-chance algorithm

- Read->10->00->Select
- Write->11->01->000->Select

<table>
<thead>
<tr>
<th>$i$</th>
<th>$j$</th>
<th>$k$</th>
<th>$l$</th>
<th>$m$</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

- $c$ = $e$
- $d$ = $b$
- $a$ = $a$
- $b$ = $b$
- $c$ = $c$
- $d$ = $d$
- $e$ = $e$