Allocation of Bits

- Factors in determining the use of the addressing bits
  - Number of addressing modes
  - Number of operands
  - Register vs. memory
  - Address range
  - Address granularity

Real Instruction Format

- PDP-8

+ Simplest instruction design for GP computer
+ 12-bit fixed length, 12-bit words
+ A signal GPR, Acc
+ Three formats
+ Support 35 instructions
+ Indirect, displacement, and indexing addressing
- **PDP-10**

<table>
<thead>
<tr>
<th>Opcode</th>
<th>Register</th>
<th>I</th>
<th>Index register</th>
<th>Memory address</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
<td>9</td>
<td>12</td>
<td>14 17 18 35</td>
</tr>
</tbody>
</table>

\( I = \text{indirect bit} \)

- **PDP-11**

- Variable-length

- 13 formats, encompassing 0-, 1-, and 2-address instruction type

- Usually one word (16-bit) long. For multiple memory address instruction, 32- and 48-bit instructions are used

- 6-bit for register reference. 3-bit identify the register (employ 8 16-bit GPRs), 3-bit for addressing mode.

- Instruction set and addressing capability are complex. Increase hardware cost and programming complexity. But more compact program can be developed.