Introduction to “Science of Programming”

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Key Points of This Lecture

- **Science of Programming**
  - science
  - programming

- **Verification of Programs**
  - propositional logic, predicate logic, first order logic
  - proof rules

- **Transformation**
  - pre-condition
  - post-condition
  - partial correctness
  - total correctness
Science of Programming

- Science
- Programming
Science of Programming

- Science
- Programming
int main (void) {
    cin >> x;
    if (x != 0)
        cout << "The program is correct";
    else
        cout << "The program is not correct";
}

Is This Program Correct?

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Another Example

There are total $n$ of coins in a bag. Each coin either has $P$ or $F$ printed on it. The player takes 2 coins at a time, and if the last coin is $P$, the player wins the game. The rules are:

<table>
<thead>
<tr>
<th>2 out</th>
<th>1 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 $P$ + 2$F$</td>
<td>1$F$</td>
</tr>
<tr>
<td>1 $P$ + 1$F$</td>
<td>1$P$</td>
</tr>
<tr>
<td>2 $P$ + 0$F$</td>
<td>1$F$</td>
</tr>
</tbody>
</table>
Example – continued

New rule:

<table>
<thead>
<tr>
<th>3 out</th>
<th>1 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 P + 3F</td>
<td>1F</td>
</tr>
<tr>
<td>1 P + 2F</td>
<td>1P</td>
</tr>
<tr>
<td>2 P + 1F</td>
<td>1F</td>
</tr>
<tr>
<td>3 P + 0F</td>
<td>1P</td>
</tr>
</tbody>
</table>
What do we conclude from the example?

- pre-condition
- post-condition
- termination
- partial correctness
- total correctness
- incorrect
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