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Solving integer/binary problems using Maple:

Let's look at the Southwestern Airways problem on p.485. Solving it using the Maple codes below gets us the correct answer presented in the textbook:

```
> with(Optimization):
>
  CS := {x[1] + x[4] + x[7] + x[10] ≥ 1, x[2] + x[5] + x[8]
      + x[11] ≥ 1, x[3] + x[6] + x[9] + x[12] ≥ 1, x[4]
      + x[7] + x[9] + x[10] + x[12] ≥ 1, x[1] + x[6] + x[10]
      + x[11] ≥ 1, x[4] + x[5] + x[9] ≥ 1, x[7] + x[8]
      + x[10] + x[11] + x[12] ≥ 1, x[2] + x[4] + x[5] + x[9]
      ≥ 1, x[5] + x[8] + x[11] ≥ 1, x[3] + x[7] + x[8]
      + x[12] ≥ 1, x[6] + x[9] + x[10] + x[11] + x[12] ≥ 1,
      sum(x[i], i = 1..12) = 3};
```

$$CS := \{1 \le x_1 + x_4 + x_7 + x_{10},\ 1 \le x_2 + x_5 + x_8 + x_{11},\ 1 \le x_3 + x_6 + x_9 + x_{12},\ 1 \le x_1 + x_6 + x_{10} + x_{11},\ 1 \le x_4 + x_5 + x_9,\ 1 \le x_2 + x_4 + x_5 + x_9,\ 1 \le x_3 + x_7 + x_8 + x_{12},\ 1 \le x_5 + x_8 + x_{11},\ 1 \le x_4 + x_7 + x_9 + x_{10} + x_{12},\ 1 \le x_6 + x_9 + x_{10} + x_{11} + x_{12},\ 1 \le x_7 + x_8 + x_{10} + x_{11} + x_{12},\ x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} + x_{11} + x_{12} = 3\}$$

```
> z := 2*x[1] + 3*x[2] + 4*x[3] + 6*x[4] + 7*x[5] + 5
    *x[6] + 7*x[7] + 8*x[8] + 9*x[9] + 9*x[10] + 8
    *x[11] + 9*x[12];
```

$$z := 2\ x_1 + 3\ x_2 + 4\ x_3 + 6\ x_4 + 7\ x_5 + 5\ x_6 + 7\ x_7 + 8\ x_8 + 9\ x_9 + 9\ x_{10} + 8\ x_{11} + 9\ x_{12}$$

```
> Minimize(z, CS, assume = binary);
```

$$[18, [x_1 = 1, x_4 = 0, x_7 = 0, x_{10} = 0, x_2 = 0, x_5 = 1, x_8 = 0, x_{11} = 0, x_3 = 0, x_6 = 0, x_9 = 0, x_{12} = 1]]$$

```
>
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