Check digit schemes

<table>
<thead>
<tr>
<th></th>
<th># of digits</th>
<th>Weights</th>
<th>Mod</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPC:</td>
<td>12</td>
<td>3,1,3,1,3,1,3,1,3,1,3,1</td>
<td>10</td>
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<tr>
<td>ISBN:</td>
<td>10</td>
<td>10,9,8,7,6,5,4,3,2,1</td>
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<tr>
<td>Routing #:</td>
<td>9</td>
<td>7,3,9,7,3,9,7,3,9</td>
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</table>

1. If a clock shows 3:30 right now,
   (a) What time will it show in 412 hours?
   (b) What time did it show 85 hours ago?

2. In 1980, the federal income tax filing deadline was on April 15. What day of the week was it? (This year April 15 was a Sunday.)

3. This year December 7 will be a Wednesday. December 7, 1991 marked the 50'th anniversary of the Pearl Harbor Attack. What day of the week was it? **Show all steps of your modular computation.**

4. Use mod arithmetic to calculate the day of the week that you were born on. Confirm the result with your parent(s) (if they remember).

5. It is currently fall. What season will it be 173 seasons from now?

6. Suppose you’re working with the alphabet in a system where, after you get to Z, you start over again at A. If you start at C and go ahead 1077 letters, what letter are you at now?

7. **Use properties of mod** to simplify the following to a single number.
   \[(74 \cdot 38 - 28 \cdot 85) \mod 8\]

8. Is 044357055121 a valid UPC?

9. Solve the mod equation \((98 + K) \mod 17 = 0\).

10. The first nine digits of the ISBN for the math textbook *For All Practical Purposes* by COMAP are 0-7167-2841. Give the correct check digit.

11. The first nine digits of the ISBN for the book *Mirror Symmetry and Algebraic Geometry* by David Cox and Sheldon Katz are 0-8218-2127. Give the correct check digit.

12. As a bank teller, someone is reading you a check routing number over the phone. You hear and write 113451177. Is this number you wrote down a valid routing number?

13. The first digit of the UPC _44357055120 is missing. Find the correct first digit.

14. Suppose a Trinket game starts with 43 trinkets and each player can remove 1, 2, 3, 4, or 5 trinkets per turn.
   (a) Determine whether Player 1 or Player 2 has the advantage.
   (b) Give the first 6 moves of the game, assuming the player with the advantage plays wisely and the losing player removes 5 trinkets on his first turn, 3 trinkets on his second turn, and 1 trinket on his third turn. (Describe each move by giving the number of trinkets left on the pile.)