Proof for Week 5

Due on Thursday, October 11th

In today's tour we discussed the calendar trick, where we found out how to determine the day of the week of any date in the twentieth century.

This week's proof will be to justify *why* this method works.

Recall the trick worked as follows:

Pick any date in the twentieth century.
Let A be the last two digits of the year.
Let B be the value of A divided by 4, rounded down. In other words, $B = \left\lfloor \frac{A}{4} \right\rfloor$.
Let C be the date.
Let D be the integer that corresponds to the month in the following table.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	3	3	6	1	4	6	2	5	0	3	5

We compute the value of $S = A + B + C + D$. One small note: If the year is a leap year *and* the month is January or February, you must subtract 1 from S.

Now divide S by 7. Whatever remainder you get corresponds to the day of the week you are seeking, namely 0 is Sunday, 1 is Monday, 2 is Tuesday, 3 is Wednesday, 4 is Thursday, 5 is Friday, and 6 is Saturday.

Answer the following questions:

a) Explain how the numbers in the above table are derived. (To clarify, if we know that January corresponds to 0, how do we know that February *must* correspond to 3?)

b) Why do we need to subtract 1 when we have a leap year and the month is January or February?

c) This method does not work for dates in the 21st century. However, we can make a slight modification to our algorithm and correctly calculate the day of the week of any date in this new century. What is this modification?