Solution to Epoch Fail

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The descriptions should be sufficient for figuring out the date of failure for each system. As noted in the instructions, source code is provided merely for clarification. When calculating the dates of all the systems manually, you must remember to keep track of leap years in order to arrive at the right date. Leap years occur on every year divisible by 4 except when the year is divisible by 100 but not by 400 (e.g., 1900 is not a leap year, but 2000 is a leap year).

The flavor text ("We think you'll excel at this") also hints that Microsoft Excel can be used to easily calculate the dates if you want to avoid manual calculation. Excel is able to add a numerical value representing a number of days to any date value to arrive at the final date, and is supposed to take into account leap years, but apparently does not treat the year 1900 correctly (see http://support.microsoft.com/kb/214326). This was not discovered until during the event, and has implications for solving the date for the Yamato Nuclear Research Facility.

Depository for Pathogenic Agents:
The date representation will overflow when the first 7 bits that represent the number of years overflows. The 4 bits used to represent the month and the 5 bits used to represent the day are irrelevant because they are sufficient for representing all values from 1-12 and 1-31, respectively. The year will overflow after 2^7 years, which is 128 years. 128 years after January 1, 1950 is January 1, 2078.

Autoridad Hidroeléctrica de Centroamérica:
Because the counter is a 16-bit binary coded decimal number where each digit is 4 digits in length, the highest possible value for the number of days that have elapsed is 9999. This means the date will overflow on the 10000th day. The epoch starts on December 1, 1990, so there are 9969 more days after January 1, 1991. 27 full years are in these 9969 days; 7 of these years are leap years. This leaves 107 days after January 1, 2018, so the date of failure will be April 18, 2018.

Yamato Nuclear Research Facility (ヤマト原子研究施設):
The date representation is correct until the counter keeping track of the number of seconds that have elapsed overflows. Because it's a 32-bit unsigned integer, the first instance of overflow is after 2^{32} seconds. This is equal to 49710 days, 6 hours, 28 minutes, and 16 seconds after January 1, 1900. There are 136 full years during those 49710 days; 33 of these years are leap years. This leaves 37 days, 6 hours, 28 minutes, and 16 seconds after January 1, 2036, so the exact time of failure will occur on February 7, 2036 at 6:28:16, but due to the aforementioned Excel issue, **February 6, 2036** was used in the solution of this puzzle.

Système National de Télécompensation:
The date representation will overflow when the first 26 bits that represent the number of minutes that have elapsed overflows. The remaining 6 bits used to represent the seconds is irrelevant because a 6-bit unsigned integer is sufficient for representing all values from 0-59. Therefore the date overflows after 2^{26} minutes have elapsed, which is equal to 46603 days, 9 hours, and 4 minutes. There are 127 full years during those 46603 days; 32 of these years are leap years. This leaves 216 days, 9 hours, and 4 minutes after January 1, 2099, so the exact time of failure will occur on August 5, 2099 at 9:04.

Once the dates of failure have been determined, you may notice that the first letters of all the facilities names spell out the word, DAYS. This is a clue indicating that only the day of each failure date is relevant. If you take each day as an index into the names of the facilities (ignoring spaces), you get 1=D, 18=C, 6=O, 5=E (ignoring the accent mark).

The instructions also note that they want to prioritize the ones that need to be fixed first, so if you order the dates from soonest to latest, you get the answer:

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