Product

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1 Explanation

This program is based on the Python version I wrote (together with Tobias Eikelenboom) for PRna. It aims to provide the functionality described in the assignment 'Product'.

2 Time

Translating the Python code to c++, getting used to c++ and debugging took around 3 hours. Tidying everything up, testing edge cases and writing the report another hour. The time spent on the original program was around 8 hours, a lot of which was spent during work colleges.

3 Analysis

I think the program could be written more efficiently using basic math operations. However, it would of been more effort to find that method than to use my existing code. Had I had more time I would of optimised the program. Moving from Python to c++ was sometimes frustrating as c++ doesn't have as many built in 'ready-to-go' functions as Python does. Par example to simply convert a string or character to lowercase.

Code

```
1  /*
2   * main.cpp
3   * Author: Julian van Doorn (2519074)
4   *
5   * This program is based on the Python version I wrote (together with
6   * Tobias Eikelenboom) for PRna.
7   *
8   * This program aims to provide the functionality described in the
9   * assignment called 'Product'. It will ask and check a user's
10  * birthday and test them on their math skills. If they fail the math
11  * test it will test their art history knowledge.
12  */
13 #include <iostream>
14 #include <cmath>
15 #include <ctime>
16 #include <cstdlib>
17
18 using namespace std;
19
20 // The current date.
```

```
21 const int YEAR = 2019;
22 const int MONTH = 9;
23 const int DAY = 23;
24
25 // The birthday
26 int birth_year;
27 int birth_month;
28 int birth_day;
29
30 // The difference between today and the birthday
31 int day_delta;
32
33 // First letter of the day they were born
34 char first_day_letter;
35 // Second (optional) letter of the day they were born.
36 char second_day_letter;
37 // A number corresponding to the day they were born.
38 int day_number;
39
40 // Our two random numbers.
41 int number1;
42 int number2;
43
44 // The answer to the second question (if needed).
45 char answer2;
46
47 int get_month_length(int y, int m) {
48     /*
49      * This function returns the length of month m in year y.
50      */
51     if (m == 2) {
52         if (y % 4 == 0) {
53             return 29;
54         } else {
55             return 28;
56         }
57     } else if (m == 1 || m == 3 || m == 5 || m == 7 || m == 8 ||
58                m == 10 || m == 12) {
59         return 31;
60     } else {
61         return 30;
62     }
63 }
64
65 int get_year_length(int y) {
66     /*
67      * This function returns the length of year y.
68      */
69     if (y % 4 == 0) {
70         return 366;
71     } else {
72         return 365;
73     }
74 }
75
76 int get_month_delta(int year1, int month1, int day1, int year2,
```

```
                    int month2, int day2) {
    /*
     * This function returns the difference in months between two
     * dates.
     */
    if (day2 >= day1) {
        return (year2 - year1) * 12 + (month2 - month1);
    } else {
        return (year2 - year1) * 12 + (month2 - month1 - 1);
    }
}

int get_month_delta(int year1, int month1, int day1) {
    /*
     * This function returns the difference in months between the
     * given date and the current date.
     */
    return get_month_delta(year1, month1, day1, YEAR, MONTH, DAY);
}

string get_day_name(int d) {
    /*
     * This function tells us which day corresponds to the remainder
     * of a day difference with reference point 1901-01-01 -> tuesday.
     */
    switch (d) {
        case 0:
            return "tuesday";
        case 1:
            return "wednesday";
        case 2:
            return "thursday";
        case 3:
            return "friday";
        case 4:
            return "saturday";
        case 5:
            return "sunday";
        case 6:
            return "monday";
        default:
            return "???";
    }
}

int get_day_delta(int year1, int month1, int day1, int year2,
                  int month2, int day2) {
    /*
     * This function returns the difference between two dates in days.
     */
    int days = 0;

    for (int y = year1; y < year2; y++) {
        if (y == year1) {
            for (int m = month1; m <= 12; m++) {
                days += get_month_length(y, m);
```

```
133             }
134             days -= day1;
135         } else {
136             days += get_year_length(y);
137         }
138     }
139
140     for (int m = 1; m <= month2; m++) {
141         if (m == month2) {
142             days += day2;
143         } else {
144             days += get_month_length(year2, m);
145         }
146     }
147
148     return days;
149 }
150
151
152 int main() {
153     // Output author information.
154     cout << "=========================================\n"
155             "| This program was written by:          |\n"
156             "| Julian van Doorn (s2518074 - 2019)    |\n"
157             "|                                       |\n"
158             "| The Assignment is called: Product     |\n"
159             "|                                       |\n"
160             "| This program will determine if, and   |\n"
161             "| if so, what kind of program you can   |\n"
162             "| do at Leiden University.              |\n"
163             "=========================================\n";
164
165     // Get the birth year and check it.
166     cout << "What year were you born in? ";
167     cin >> birth_year;
168     if (YEAR - birth_year < 10 || YEAR - birth_year > 101) {
169         cout << "You are too old or young.";
170         return 1;
171     }
172
173     // Get the birth month and check it.
174     cout << "What month were you born in (1-12)? ";
175     cin >> birth_month;
176     if (birth_month < 1 || birth_month > 12) {
177         cout << "That month is invalid.";
178         return 1;
179     } else if ((YEAR - birth_year == 10 && birth_month > MONTH) ||
180                (YEAR - birth_year == 101 && birth_month < MONTH)) {
181         cout << "You are too old or young.";
182         return 1;
183     }
184
185     // Get the birth day and check it.
186     cout << "What day were you born on? ";
187     cin >> birth_day;
188     if (birth_day < 1 ||
```

```
189         birth_day > get_month_length(birth_year, birth_month)) {
190         cout << "That day is invalid.";
191         return 1;
192     } else if ((YEAR - birth_year == 10 && birth_month == MONTH &&
193                 birth_day > DAY) ||
194                (YEAR - birth_year == 101 and birth_month == MONTH and
195                 birth_day <= DAY)) {
196         cout << "You are too old or young.";
197         return 1;
198     }
199
200     // Tell the user how old they are (in years/months and in just
201     // months).
202     cout << "You are " << floor(
203             get_month_delta(birth_year, birth_month, birth_day) / 12)
204          << " years and "
205          << get_month_delta(birth_year, birth_month, birth_day) % 12
206          << " months old.\n";
207     cout << "Or we could say that you are just "
208          << get_month_delta(birth_year, birth_month, birth_day)
209          << " months old.\n";
210
211     // Check if they have their birthday.
212     if (birth_month == MONTH && birth_day == DAY) {
213         cout << "Happy b-day!\n";
214     } else if (birth_day == DAY) {
215         cout << "Happy m-day!\n";
216     }
217
218     // Calculate the difference in days between 1901-01-01 and their
219     // birthday.
220     day_delta = get_day_delta(1901, 1, 1, birth_year, birth_month,
221                               birth_day);
222
223     // Get the first letter of the day the user was born.
224     cout << "Enter the first letter of the day you were born on "
225             "(m, t, etc.): ";
226     cin >> first_day_letter;
227
228     // Check if it could be multiple days (t/s).
229     if (first_day_letter == 't' || first_day_letter == 'T') {
230         // Get the second letter of the day the user was born.
231         cout << "Enter the second letter of the day you were born on "
232                 "(h/u): ";
233         cin >> second_day_letter;
234
235         // Match it with a day (number).
236         if (second_day_letter == 'h' || second_day_letter == 'H') {
237             day_number = 2; // Thursday
238         } else if (second_day_letter == 'u' ||
239                    second_day_letter == 'U') {
240             day_number = 0; // Tuesday
241         } else {
242             cout << "Invalid day letters.";
243             return 1;
244         }
```

```
245     } else if (first_day_letter == 's' || first_day_letter == 'S') {
246         // Get the second letter of the day the user was born.
247         cout << "Enter the second letter of the day you were born on "
248                 "(a/u): ";
249         cin >> second_day_letter;
250 
251         // Match it with a day (number).
252         if (second_day_letter == 'a' || second_day_letter == 'A') {
253             day_number = 4; // Saturday
254         } else if (second_day_letter == 'u' ||
255                    second_day_letter == 'U') {
256             day_number = 5; // Sunday
257         } else {
258             cout << "Invalid day letters.";
259             return 1;
260         }
261     } else {
262         // Else match the first letter with a day.
263         if (first_day_letter == 'm' || first_day_letter == 'M') {
264             day_number = 6; // Monday
265         } else if (first_day_letter == 'w' ||
266                    first_day_letter == 'W') {
267             day_number = 1; // Wednesday
268         } else if (first_day_letter == 'f' ||
269                    first_day_letter == 'F') {
270             day_number = 3; // Friday
271         } else {
272             cout << "Invalid day letter.";
273             return 1;
274         }
275     }
276 
277     // Check if the user inputted the right day.
278     if (day_delta % 7 != day_number) {
279         // This print statement was mostly for debug purposes.
280         cout << "Wrong. You were born on "
281              << get_day_name(day_delta % 7) << ".";
282         return 1;
283     }
284 
285     // Initialize a random number generator.
286     srand(time(0));
287     // Generate two random numbers.
288     number1 = rand() % 10000 + 1;
289     number2 = rand() % (10000 - number1) + 1;
290     // There is a 10% chance of number1 being zero.
291     if (rand() % 10 + 1 == 1) {
292         number1 = 0;
293     }
294 
295     int answer;
296 
297     // Ask the user about the product.
298     cout << "What is the product of " << number1 << " and " << number2
299          << "? ";
300     cin >> answer;
```

```
301
302     // Check if the answer was correct.
303     if (0.9 * number1 * number2 <= answer &&
304         answer <= 1.1 * number1 * number2) {
305         cout << "Correct! You can start an exact program.";
306         return 0;
307     }
308
309     // If it was wrong we shall test their art history knowledge.
310     cout << "You were wrong.. we will now test your art history "
311             "knowledge.\n";
312
313     // Check if the user is 30.
314     if (get_month_delta(birth_year, birth_month, birth_day) / 12 >=
315         30) {
316         cout << "The Nachtwacht was painted by:\n"
317                 "a) Rembrand;\n"
318                 "b) Shirley Temple;\n"
319                 "c) James Bond;\n"
320                 "d) Trick question: The Nachtwacht is a peanut butter"
321                 " brand.\n"
322                 "Enter a/b/c/d: ";
323     } else {
324         cout << "On average, Van Gogh had:\n"
325                 "a) one ear;\n"
326                 "b) two ears;\n"
327                 "c) three ears;\n"
328                 "d) no ears.\n"
329                 "Enter a/b/c/d: ";
330     }
331
332     // Get the second answer.
333     cin >> answer2;
334     // Check if it was correct.
335     if (answer2 == 'a' || answer2 == 'A') {
336         cout << "Correct! You can start a art history program.";
337         return 0;
338     } else {
339         cout << "Wrong! You may not start with anything.";
340         return 1;
341     }
342 }
```