Mohdeep Singh109600239 msingh820@mySeneca.ca  
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*There are many notes in the instructions to help you earn marks for the questions below.*

Exercise One of Two – **integer overflow** (80 points)

1) 🡺 (7.5 points) ) If a variable counting seconds is stored in a signed **long** 32-bit integer, how many **days** will it take until that integer overflows? (to one decimal place)

1. If we sign a 32-bit integer, It has a max value of 2,147,483,647.

2. If a variable counting hundreths of a second is stored, it gives maximum value of

2,147,483,647/100= 21,474,836.47 seconds.

3. there are 60\*60\*24 = 86,400 seconds each day.

4. value of context of days is 21,474,836.47/86,400 = 248.55134…

5. Hence, the value to 2 dec is 248.55

2) 🡺 (15 points) Convert the maximum value of an unsigned **long** 32-bit integer, representing hundredths of a second, into whole numbers of  
 days : hours : minutes : seconds . hundredths of a second.   
After *n* days, how many hours remain? After *n* hours, how many minutes remain? etc.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **248** | **13** | **13** | **56** | **47** |
| **DAYS** | **HOURS :** | **MINUTES :** | **SECONDS .** | **HUNDREDTHS** |

3) 🡺 (2.5 points) What are the maximum and minimum values that can be stored in a **short** 16-bit signed integer?

16-bit signed integer maximum = 32767 … minimum = -32768

4) 🡺 (5+5 points) Give examples of two **short** 16-bit signed integers that when added together would cause overflow.

 16384 +  16385 are two positive values causing overflow when added together.

-17569 + (-17000) are two negative values causing overflow when added together.

Binary Search Bug

5) 🡺 (10 points) What is potentially wrong with the **(low + high) / 2** calculation to find the middle point? Under what conditions would the calculation go wrong?

Calculation of (low/high)/2 to find the mid point may nor always gives you correct result. One particular condition where the calculation may go wrong is when we deal with integer or floating-point arithmetic with rounding errors..when both low and high are integers or float, their sum can exceed the range of representable value, especially when the number s are big. This can lead to overflow or precision loss. To avoid the situation we may can use this formula low + (high-low)/2. This formaula elimailate the overflow and guarantee the accurate result.

6) 🡺 (10 points) REWRITE themidcalculation to prevent overflow*from*mid = (low + high) / 2;*to*  **mid = low +(high -low) / 2 ;**

7) 🡺 (25 points)Write a 250+ word “reflection”(similar to a workshop in your programming class) describing the steps you used to develop and test your solution to the calculation bug.

A group of numbers that contains both the highest and lowest conceivable values is referred to as the range of values. When these extreme values are added together, the result might occasion ally become too large to handle and result in an issue known as overflow. When the programme is compiled and run, this can result in unanticipated and dangerous effects.

We need to come up with another approach to get around this problem. One strategy is to divide the high value by the low value rather than combining the two. We can avoid the potential for obtaining a very huge result that might result in overflow by doing this. Although this approach has several drawbacks of its own, it is regarded as secure because subtracting two integers would never yield a greater value.

As a result of adding high and low values, an unexpected result may result. We may safely prevent this by choosing the safer alternative of subtracting the low number from the high value. This alternate strategy has limits, but it works because it doesn't provide any risks and guarantees that the two values will be distinct from one another. There are many ways where we can check the bugs and correct it using some programs or code.For this Activity we cam eto know that this formaula is used to avoid overflow situation. **mid = low +(high -low) / 2**

Exercise Two of Two – **Numbering Systems and Conversions (20 points)**

8) 🡺 (10 points ) What is the hex value for these colours?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Red decimal | Green decimal | Blue decimal | Hex triplet | Colour Description |
| 15 | 245 | 231 | OFF5E7 | Cyan color |
| 192 | 255 | 238 | COFFEE | Dark brownish |
| 208 | 13 | 30 | DOOD1E | Light brown color(light wood) |
| 186 | 187 | 30 | BABB1E | Dark olive color |
| 126 | 164 | 112 | 7EA470 | Green and yellow mix |

9) 🡺 (10 points)Fill in this chart as per the column headings

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hex triplet | Red decimal | Green decimal | Blue decimal | Describe the Final Colour *and* change the cell's background colour, i.e. R-click and see MS Word 'Shading' |
| #302432 | 48 | 36 | 50 |  |
| #204C02 | 32 | 76 | 2 |  |
| #D64A53 | 214 | 74 | 83 |  |
| #404891 | 64 | 72 | 145 |  |