

Check That Digit Solutions

- The check digit should be 1.
 - Yes, this number is accurate.
- When the original digits are multiplied by 1 and 3 and the transposed digits are multiplied by 1 and 3, the difference of the two sums is 10. This is a problem because the sums of both UPC numbers will yield a remainder of zero when divided by 10.
- The larger companies need to have the third block of the ISBN be comprised of more digits because they publish more books. Where the smaller companies publish fewer books and can therefore have larger identification numbers.
- 1-81-_____- check digit. $10^6 = 1,000,000$ editions
- ${}_{10}P_6$ or $10 \times 9 \times 8 \times 7 \times 6 \times 5 = 151,200$ editions
- The ISBN system detects all transposition errors because each digit is multiplied by a different number, none of which divide evenly by 11, the modulus. Thus emphasizing the importance of the check digit.
- There would be 10^6 or 1,000,000 possible issue identifiers.
- There would be 12 available spaces for use ($19-6-1=12$). There are 10 digits (0-9) that could be used in each of the 12 spaces. Therefore, there are a possible 10^{12} or 1,000,000,000,000 account numbers.
- Each beginning two-digit number would have $10^4 = 10,000$ possibilities. Therefore, multiply 10,000 by 2 (for the 51 and 55) for a total of 20,000 possibilities. This is assuming all four digits are used in each sequence.]
- The check digit is 4.
- The sum would at most be off by 9 because you are adding single digits that range from 0-9. The error would be detected because the check process would not yield an answer that was divisible by 10.
- Listing all digits from 0 – 9, the double of these digits and the resulting sums shows all the sums are unique. Any change in an even-positioned digit would result in a sum different than what it should have been.
- The digits that cannot be detected are 0 and 9. These are unique because the value of these two digits will always be a 0 and 9 regardless of their position in the account number. If the 9 is in the even-numbered position it will be doubled resulting in 18 with a sum of $1+8=9$ and the 0 in the odd-numbered position would be unaffected. On the other hand, if 0 were in the even-

numbered position, its value doubled would still be 0 and when added to the 9 the sum is still 9. Either way the sum of the two is nine.

14. The only other circumstance would be if two of the same digits were transposed. This would have no effect on validating the account number.

15. Debit cards, bank account numbers, phone numbers, student id numbers, express shipping services, other identification numbers