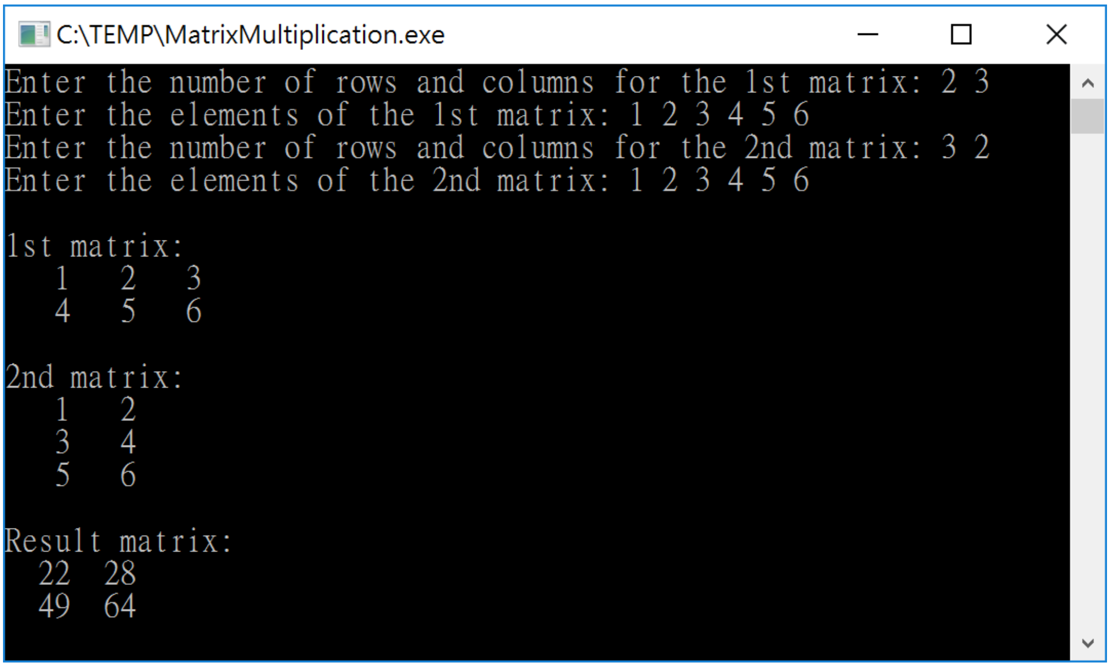
6.19 ***(Dice Rolling)*** Write a program that simulates the rolling of two dice. The program should use rand to roll the first die, and should use rand again to roll the second die. Since each die can show an integer value from 1 to 6, then the sum of the two values will vary from 2 to 12, with 7 being the most frequent sum and 2 and 12 the least frequent sums. The following diagram shows the 36 possible combinations of the two dice. Your program should roll the two dice 36,000 times. Use a single-subscripted array to tally the numbers of times each possible sum appears. Print the results in a tabular format. Also, determine if the totals are reasonable, i.e., there are six ways to roll a 7, so approximately one-sixth (1/6 ~ 0.16667) of all the rolls should be 7.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

```
Sum     Total   Expected    Actual
  2      1018     2.778%     2.828%
  3      2008     5.556%     5.578%
  4      3020     8.333%     8.389%
  5      4024    11.111%    11.178%
  6      4891    13.889%    13.586%
  7      6011    16.667%    16.697%
  8      5065    13.889%    14.069%
  9      3984    11.111%    11.067%
 10      2970     8.333%     8.250%
 11      1989     5.556%     5.525%
 12      1020     2.778%     2.833%
```

ANS:

6.21 ***(Matrix Multiplication)*** An m×n two-dimensional matrix can be multiplied by another p×q matrix to give a m×q matrix (if n=p) whose elements are the sum of the products of the elements within a row from the first matrix and the associated elements of a column of the second matrix. Write a program to calculate the product of two matrices and store the result in a third matrix. The program execution looks like:



ANS:

6.30 ***(The Sieve of Eratosthenes)*** A prime integer is any integer greater than 1 that can be divided evenly only by itself and 1. The Sieve of Eratosthenes is a method of finding prime numbers. It works as follows: (a) Create an array with all elements initialized to 1 (true). Array elements with prime subscripts will remain 1. All other array elements will eventually be set to zero. (b) Starting with array subscript 2 (subscript 1 is not prime), every time an array element is found whose value is 1, loop through the remainder of the array and set to zero every element whose subscript is a multiple of the subscript for the element with value 1. For array subscript 2, all elements beyond 2 in the array that are multiples of 2 will be set to zero (subscripts 4, 6, 8, 10, and so on.). For array subscript 3, all elements beyond 3 in the array that are multiples of 3 will be set to zero (subscripts 6, 9, 12, 15, and so on.). When this process is complete, the array elements greater than 1 that are still set to 1 indicate that the subscript is a prime number. Write a program that uses an array of 1000 elements to determine and print the prime numbers between 1 and 999.

```
Find all prime numbers up to a given integer: 1000
All primes up to 1000 (Sieve of Eratosthenes):
2 3 5 7 11 13 17 19 23 29
31 37 41 43 47 53 59 61 67 71
73 79 83 89 97 101 103 107 109 113
127 131 137 139 149 151 157 163 167 173
179 181 191 193 197 199 211 223 227 229
233 239 241 251 257 263 269 271 277 281
283 293 307 311 313 317 331 337 347 349
419 421 431 433 439 443 449 457 461 463
467 479 487 491 499 503 509 521 523 541
547 557 563 569 571 577 587 593 599 601
607 613 617 619 631 641 643 647 653 659
661 673 677 683 691 701 709 719 727 733
739 743 751 757 761 769 773 787 797 809
811 821 823 827 829 839 853 857 859 863
877 881 883 887 907 911 919 929 937 941
947 953 967 971 977 983 991 997
A total of 168 prime numbers were found in this range.
```

ANS: