

## Shuffling card

Shuffling card is an essential part of every card game. There are many techniques for shuffling cards such as, overhand and riffle etc. However, randomization based shuffling algorithms runs faster and gives consistent results. These algorithms rely on randomization to generate a unique random number on each iteration. Randomized algorithms are useful in applications that require good results consistently irrespective of input to the algorithms.

Fisher-Yates shuffle is one such algorithm for achieving a perfect shuffle using a random number generator. The algorithm is named after Ronald Fisher and Frank Yates who first described this algorithm in their book in 1938. Later Donal Knuth and Richard Durstenfeld introduced an improved version of the algorithm in 1964.

Unlike swapping items at two different indexes, algorithm generates a random number  $k$  between range of the elements inside an array. Every iteration updates the last element in the range thus random generator works on the new range on every iteration and generates a unique number every time.

Example:

```
Input : arr[] = {1, 2, 3, 4, 5, 6, 7, 8}
Output : arr[] = {7, 8, 4, 6, 3, 1, 2, 5}
The output can be any random permutation
of input such that all permutations are
equally likely.
```

Let the given array be `arr[]`. A simple solution is to create an auxiliary array `temp[]` which is initially a copy of `arr[]`. Randomly select an element from `temp[]`, copy the randomly selected element to `arr[0]` and remove the selected element from `temp[]`. Repeat the same process  $n$  times and keep copying elements to `arr[1]`, `arr[2]` etc.

### Algorithm:

1. First, fill the array with the values in order.
2. Go through the array and exchange each element with the randomly chosen element in the range from itself to the end.

```

void shuffle(int card[], int n)
{
    // Initialize seed randomly
    srand(time(0));

    for (int i=0; i<n ;i++)
    {
        // Random for remaining positions.
        int r = i + (rand() % (52 -i));

        swap(card[i], card[r]);
    }
}

// Driver code
int main()
{
    // Array from 0 to 51
    int a[] = {0, 1, 2, 3, 4, 5, 6, 7, 8,
               9, 10, 11, 12, 13, 14, 15,
               16, 17, 18, 19, 20, 21, 22,
               23, 24, 25, 26, 27, 28, 29,
               30, 31, 32, 33, 34, 35, 36,
               37, 38, 39, 40, 41, 42, 43,
               44, 45, 46, 47, 48, 49, 50,
               51};

    shuffle(a, 52);
    return 0;
}

```