This output will be quite long, since it will demonstrate that it stretched my capacity in numerous ways. As each number is drawn, it is combination without replacement. The Red comments are not output, it is highlighting the outputs....

I have also tried to check if more than 24 combinations exist by changing the following code:

} while (s.size()<combinations);

However the software continued to run indefinitely.. Hence 24 is the correct limit since the set size set.size() did not grow larger than 24.

*********** OUTPUT   **********************

Note: Combination.java uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.
Welcome to Online IDE!! Happy Coding :)
COMBINATIONS (WITHOUT REPLACEMENT)
P(4,4) = 4! / (4!(4-4)!)
Combinations: 24   (This will be maximum limit for set size)

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 1   // set size increases as it makes a unique entry

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 2

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 415
set size: 3

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 4

Size of list: 4
random number: 1

This is number in list: 7
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 10
set size: 5

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 6

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 7

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 0

This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 415
set size: 8

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 76
set size: 9

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 415
set size: 10

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 0

This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 415
set size: 11

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 415
set size: 12

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 10
set size: 12

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0

This is number in list: 10
set size: 13

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 7
set size: 14

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 15

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 7
set size: 16

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 415
set size: 16   //set size will remain same if not unique combination

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 415
set size: 16

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 10
set size: 17

Size of list: 4
random number: 3

This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 17

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 18

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 18

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 0

This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 415
set size: 18

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 415
set size: 19

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 10
set size: 19

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2
random number: 0

This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 415
set size: 19

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 19

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 19

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0

This is number in list: 10
set size: 19

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 19

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 20

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 20

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 20

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 20

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 21

Size of list: 4
random number: 0
This is number in list: 10

Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 21

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 1
This is number in list: 76

Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 415
set size: 21

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 2
This is number in list: 76
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 21

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 21

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 0
This is number in list: 10

Size of list: 1
random number: 0
This is number in list: 76
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 415
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7

set size: 21

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 10
set size: 21

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 10
set size: 21

Size of list: 4

random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 21

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 10
set size: 22

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 22

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3

random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 22

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 1
This is number in list: 76
Size of list: 2

random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 415
set size: 22

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 0
This is number in list: 10
Size of list: 2
random number: 0
This is number in list: 7
Size of list: 1
random number: 0
This is number in list: 76
set size: 22

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 0
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 415
Size of list: 1
random number: 0
This is number in list: 76
set size: 22

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 7
Size of list: 1

random number: 0
This is number in list: 10
set size: 22

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 3
This is number in list: 415
Size of list: 3
random number: 1
This is number in list: 7
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 10
set size: 22

Size of list: 4
random number: 2
This is number in list: 76
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 0
This is number in list: 10
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 7
set size: 22

Size of list: 4
random number: 1
This is number in list: 7
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 0
This is number in list: 10
Size of list: 1
random number: 0
This is number in list: 76
set size: 23

Size of list: 4
random number: 1

This is number in list: 7
Size of list: 3
random number: 2
This is number in list: 415
Size of list: 2
random number: 1
This is number in list: 76
Size of list: 1
random number: 0
This is number in list: 10
set size: 24

Number cycles: 66   // it has taken 66 cycles, which is still only 44 more
                              than expected 24

Original list: [10, 7, 76, 415]
highest is: 77641510

** Process exited - Return Code: 0 **

/
*** CODE **

```
/*
Online Java - IDE, Code Editor, Compiler

Online Java is a quick and easy tool that helps you to build, compile, test your programs
online.
*/

// This has been created to ensure I can utilize any random functions more efficiently.
// It is a creation of the NcR    combinations calculator.
// It has used techniques I learnt including recursion and also memoization to speed up
execution.
// I will incorporate this into Java applications I created previously..

import java.math.*;
import java.util.*;


class largestNumber
{
    long combinations;
    int count;
```

```java
    String temp;

    Set <String> s = new HashSet <>();   // this will store the  combinations

    List <Integer> lst = new ArrayList<>(Arrays.asList(10,7,76,415));  // this is list of numbers. In
future, it will be chosen to use other data

    List <Integer> copy = new ArrayList<>(lst);  //keeps a copy    // this list keeps a copy since
during program execution the top list is modified


    public largestNumber(long combinations)
    {

        this.combinations=combinations;
        int randomNumber;   // random  number generated
        int numberArray;    // value at index of randomNumber in the set

        Random rand = new Random();  // generates random number

        System.out.println("Combinations: " + combinations +"\n");  //number combinations
without replacement


        do
        {

            lst = new ArrayList<>(copy);     // each time it starts again, it has to get the original
ArrayList back

            temp="";   // this is used concatenation of value before it is stored in the set....

            do
            {
                System.out.println("Size of list: " + lst.size());        //size list

                randomNumber = rand.nextInt(lst.size());                //random number between  0 -
(size list-1)
                System.out.println("random number: " + (randomNumber));

                numberArray = lst.get(randomNumber);   //gets number from the list
                System.out.println("This is number in list: " + numberArray);   //corresponding value
in list

                temp =  temp + Integer.toString(numberArray);   // concatenating the values

                lst.remove(randomNumber);     // this is important step.. it removes value at this
index from list... enforce combination without replacment

                //System.out.println("value of i: " + i + "\n");

            } while (!lst.isEmpty());           // it will keep processing while this is true....   while list is
not empty
```

```java
            s.add(temp);   // adding the value to the set.
            System.out.println("set size: " + s.size() +"\n");   //once this has incremented, the set
has grown...


        count++;   // this is indication of a cycle.. It is aiming to be close to combinations...


        } while (s.size()<combinations);    // this is 1 less due to 0 indexing of the set.


        System.out.println("Number cycles: " + count);

        System.out.println("Original list: " + copy.toString());  //original list outputted to the
screen
        System.out.println("highest is: " + checkMaximum());     // function call to check for
maximum

    }

    public int checkMaximum()
    {
        int highest=0;

        for (String m: s)    // checks each string in the set
        {
           if (Integer.valueOf(m)>highest)   // greater than initial 0.. Strings are converted back to
//integer
           {
               highest=Integer.valueOf(m);     // it will store value
           }

        }

        return highest;
    }
}


public class Combination
{
    public static void main(String[] args) {
        System.out.println("Welcome to Online IDE!! Happy Coding :)");

        int originalNumber=4;
        int n=originalNumber;
        int r =4;
        Map <Integer, Long> m = new HashMap<>();
        System.out.println("***COMBINATIONS***  (WITHOUT REPLACEMENT)");
System.out.println("C(n,r) =   n! /  (r!(n−r)!)");
        System.out.println("C(" + n+","+r+") = " + n+"!" + " / " + "("+r+"!"+"("+n+"-"+r+")!)");
```

```java
        largestNumber ln = new largestNumber(Combinations (n,r,originalNumber, m));

    }

    public static long Combinations (int n,  int r, int originalNumber, Map factorialResults)
    {

        // n are objects
        // r is sample

        /*
        ***CALCULATION***
        P(n,r) =  n! /  (r!(n−r)!)

        */

        long result=0;
        int denominator1;
        int denominator2;

        if (n>=1)
        {
            // EXAMPLE

            // P (5,6)  =  6* 5* 4 * 3 * 2 * 1  /  6! (6-5)!   =   720 / (5! * 1!) = 120 / 5*4*3*2*1  *
1  = 720 / 120 = 6

            result = (n* (Combinations (n-1, r,originalNumber, factorialResults)));   // this completes
factorial for numerator

            factorialResults.put(n,result);   //result stored in the Map
            //System.out.println("getting result back out: " + factorialResults.get(n));


            if (n==originalNumber)   // this will occur once
            {

                denominator1 = originalNumber-r;      // originalNumber required since n has reduced
as part of the recursive calls

                denominator2 = r;               // r sample size has not changed


                // this is using the Java Memoization technique to ensure the factorial outcome is not
calculated again, to save program cycles.
                // since the returns are done in reverse order.... n = 1 is processed first and n=6 last...
Hence in practice
                // there will be entry in Map for all factorials, ready for the denominator..


                if (factorialResults.containsKey(denominator1) &&
factorialResults.containsKey(denominator2))
```

```java
        {
            //System.out.println("here");
            //System.out.println("This is exact value of factorial  " + (denominator1) + " : " +
factorialResults.get(denominator1));
            //System.out.println("This is exact value of factorial  " + (denominator2) + " : " +
factorialResults.get(denominator2));

            return result / ((long) factorialResults.get(denominator1) *
(long)factorialResults.get(denominator2));
        }

    }

        return result;

    }
     return 1;    // it will reach here when this condition is not met  (n>=1)
    }

 }
```