MAD 4203 - COMBINATORICS FLORIDA INT'L UNIV

REVISION FOR TEST #1

REMEMBER TO BRING AN 8x11 BLUE EXAM BOOKLET FOR THE TEST

KEY DEFINITIONS AND MAIN CONCEPTS

Equivalence, Addition, & Multiplication Principles; the number of divisors and the sum of the divisors of a number n, permutations and r-permutations of a set, inversion sequence of a permutation, total number of inversions in a permutation, r-combinations of a set, circular permutations of a set, multi-sets, permutations of finite multi-sets, r-permutations of special kinds of multi-sets (permutations with repetition, etc.), r-combinations of special kinds of multi-sets (combinations with repetition, etc.), Integer solutions of the equation x1 +. . .+ xk = r with mi ≤xi , Binomial theorem, Binomial identities, Multinomial theorem, Newton's Binomial theorem, Counting different classes of functions from A to B (all functions, injective ones, surjective ones, strictly increasing ones, non-decreasing ones), Placing labelled or un-labelled balls in labelled or un-labelled boxes, Universal sets, positive sets, order of a positive set, facts about positive sets, Inclusion-Exclusion Theorem, derangements (deranged permutations), non- consecutive permutations, r-combinations of finite multi-sets, Integer solutions of the equation x1 +. . .+ xk = r with mi ≤ xi ≤ ni, Non-consecutive permutations, Ultimate sets, facts about ultimate sets, consistency of data.

MAIN PROBLEM SOLVING TECHNIQUES:

1. Finding the size of a finite set by using the equivalence or multiplication principles and finding

 the number of divisors and the sum of the divisors of a number n - from its prime factorization.

2. Finding the number of r-permutations or r-combination of a set.

3. Finding the inversion sequence of a permutation and vice versa.

4. Finding the number of r-permutations of multi-sets or r-permutations with repetitions.

5. Finding number of integer solutions of x1 +. . .+ xk = r with mi ≤ xi .

6. Finding the number of r-combinations of multi-sets or r-combinations with repetitions.

7. Analytic proofs, Combinatorial proofs, & Proofs by Induction of Binomial identities.

8. Using the Inclusion-Exclusion Theorem (IET) to obtain results & to solve problems.

9. Finding the number of r-combinations of a finite multi-set by the IET.

10. Finding number of integer solutions of x1 +. . .+ xk = r with mi ≤ xi ≤ ni.

MAIN FORMULAS & THEOREMS

0. Number of divisors of n = pk . ql . rm  is (k+1).(l+1).(m+1) with p,q,r being different primes.

1. No. of r-permutations of the set {a1 , . . , an}, P(n,r) = n! **/** (n-r)!

2. No. of r-combinations of the set {a1 , . . , an}, C(n,r) = n! **/** {r! (n-r)!}

3. No. of permutations of the multi-set [n1.a1,. . ., nk.ak] is (n1+n2+...+nk)! **/** {n1! n2! ... nk!

4. Number of r-permutations of the multi-set [∞.a1,. . ., ∞.ak] is given by PR(k,r) = (k)r

5. No. of r-combinations of the multi set [∞.a1,. . . ,∞.ak], CR(k,r) = C(r+k-1, k-1) = C(r+k-1, r)

6. Binomial, Multinomial, & Newton's Binomial Theorems; & theorems on Binomial identities.

7. Inclusion-Exclusion Theorem (IET) and the theorems on the formulas for Dn & Qn .

8. (a) D0=1 & Dn = n.Dn-1 + (-1)n (b) Dn = (n-1).(Dn-1+Dn-2) (c) Qn = Dn + Dn-1