

COL202 Major

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TOTAL POINTS

31 / 40

QUESTION 1

1 Problem 1 5 / 5

! + 1 pts Calculate the number of ways in which k fixed points can be chosen out of n points.

! + 1 pts State that the left out $(n-k)$ elements must not be fixed.

! + 2 pts Calculate the number of derangements of those $(n-k)$ elements.

! + 1 pts Combine the two findings to reach the conclusion

⚡ - 1 pts Proof writing guidelines not followed.

⚡ + 0 pts Incorrect / Not attempted

QUESTION 2

Problem 2 5 pts

2.1 Problem 2.1 2 / 2

! + 2 pts All Correct

⚡ + 0 pts Incorrect/Unattempted

⚡ + 1 pts Series form of Exponential generating function

⚡ + 1 pts Closed form of Exponential generating function

2.2 Problem 2.2 3 / 3

! + 0.25 pts EGF for oddness

! + 0.75 pts EGF for one partition even + one

partition odd

! + 0.25 pts Short explanation for the above EGF

! + 0.75 pts EGF for both partitions even

! + 0.25 pts Short explanation for the above EGF

! + 0.25 pts Final EGF

! + 0.5 pts Explicit formula for p_n

⚡ + 1 pts Overcounting/undercounting the partitions

⚡ + 0 pts Incorrect/Unattempted

QUESTION 3

Problem 3 8 pts

3.1 Problem 3.1 3 / 3

Prove that every pair of this poset has a meet and a join, thereby concluding that it is a lattice.

! + 0.75 pts Give expressions for the meet and join of any two arbitrary elements of the poset.

! + 0.75 pts Prove that the stated meet and join are actually the meet and join of the two elements.

Prove that every subset of this lattice has a meet and a join, thereby concluding that the lattice is a complete lattice.

! + 0.75 pts Give expressions for the meet and join of any arbitrary subset of the lattice.

! + 0.75 pts Prove that the stated meet and join are actually the meet and join of the subset.

☹ - 1 pts Proof writing guidelines not followed.

☹ + 0 pts Not attempted / Incorrect.

3.2 Problem 3.2 5 / 5

! + 0.5 pts *Mention the method of proof*

! + 1 pts *The minimum value that x can take is $(1, 1, \bar{E}, 1)$ and the maximum value that x can take is (n, n, \bar{E}, n)*

! + 1 pts *The least change in the value of x can be in one coordinate value*

! + 1.5 pts *As $f(x)$ is monotonic, the value of $f(x)$ differs from the previous $f(x)$ at one position and is 1 more than the value at that position in x*

! + 1 pts *Conclusion that the loop can run for a maximum of $n \cdot k$ times*

☹ + 0 pts Incorrect

QUESTION 4

Problem 4 11 pts

4.1 Problem 4.1 0 / 3

☹ - 0 pts Correct

! - 1 pts *Did not argue when 3SAT is unsatisfiable.*

☹ - 2 pts *Showed an un-satisfiable 3SAT but did not argue about its construction.*

☹ - 1 pts *Did not show an example for un-satisfiable 3SAT*

! - 2 pts *Did not argue about the construction of the equation and did not show an example for an un-satisfiable 3SAT..*

☹ - 3 pts *Incorrectly argued about construction of 3SAT*

There will not be $6C3 \times 2^3 = 160$ total clauses

4.2 Problem 4.2 0 / 6

☹ + 1.5 pts *Observing that probability of a clause to be true is $7/8$*

☹ + 2 pts *Showing expectation of these will be $7m/8$*

☹ + 1.5 pts *Arguing > 0 probability for R.V. to be greater than it's expectation*

☹ + 1 pts *Argument about existence of Ceiling*

☹ - 1 pts *Not following proof guidelines*

! + 0 pts *Incorrect/ Not attempted*

4.3 Problem 4.3 2 / 2

! + 1 pts *If less than 8 clauses, then all the clauses will be true (using Problem 4.2)*

! + 0.5 pts *Give examples for $m = 7, 6$ etc*

! + 0.5 pts *Conclusion*

☹ + 0 pts incorrect

QUESTION 5

5 Problem 5 5 / 5

☹ + 5 pts Correct

☹ + 2 pts *p1: Formally write f and prove surjection or injection from \mathcal{N}^* to \mathcal{N}*

☹ + 2 pts *p2: Formally write g and prove surjection or injection from \mathcal{N} to \mathcal{N}^**

☹ + 1 pts *p3: Use Schroder Bernstein theorem to prove the cardinality of both sets*

! + 2 pts *P1: Formally write the bijection f from \mathcal{N}^* to \mathcal{N}*

! + 1.5 pts *P2: Argue that the above function is one-one*

! + 1.5 pts *P3: Argue that the above function is onto*

££ + 1.5 pts P2: Write the inverse g of f

££ + 1.5 pts P3: Argue that the above function

g is indeed inverse of f

££ + 0 pts No solution / incomplete solution

££ - 0.5 pts P4: For not following the guidelines of proof

QUESTION 6

6 Problem 6 6 / 6

! - 0 pts *Correct*

££ - 6 pts Not attempted or nothing substantial written.

££ - 5 pts Wrong or missing idea or proof details

££ - 5 pts Induction on trees cannot be done by adding a node/edge to create a larger tree. This requires a proof that all possible trees of this size can be generated this way. That proof will further bring you back to working with the tree that results from removal, so the argument is circular. This point has been made in class multiple times.

££ - 1 pts Induction variable not clearly and/or separately specified

££ - 1 pts Missed discussing the case where the walk begins at the removed vertex.

££ - 1 pts Missed discussing the case where the walk doesn't begin at the removed vertex.

££ - 4 pts Right direction but incorrect/incomplete arguments.

££ - 1 pts Wrong way of writing the induction hypothesis or missing induction hypothesis

££ - 0.5 pts Missed $\forall v \in V$ in the statement.

