

# NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Mathematics

Subject Co-ordinator - Prof. Sudarshan Iyengar

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Motivation for Counting  
Lecture 2 - Paper Folding Example  
Lecture 3 - Rubik's Cube Example  
Lecture 4 - Factorial Example  
Lecture 5 - Counting in Computer Science  
Lecture 6 - Motivation for Catalan numbers  
Lecture 7 - Rule of Sum and Rule of Product  
Lecture 8 - Problems on Rule of Sum and Rule of Product  
Lecture 9 - Factorial Explained  
Lecture 10 - Proof of  $n!$  - Part 1  
Lecture 11 - Proof of  $n!$  - Part 2  
Lecture 12 - Astronomical Numbers  
Lecture 13 - Permutations - Part 1  
Lecture 14 - Permutations - Part 2  
Lecture 15 - Permutations - Part 3  
Lecture 16 - Permutations - Part 4  
Lecture 17 - Problems on Permutations  
Lecture 18 - Combinations - Part 1  
Lecture 19 - Combinations - Part 2  
Lecture 20 - Combinations - Part 3  
Lecture 21 - Combinations - Part 4  
Lecture 22 - Problems on Combinations  
Lecture 23 - Difference between Permutations and Combinations  
Lecture 24 - Combination with Repetition - Part 1  
Lecture 25 - Combination with Repetition - Part 2  
Lecture 26 - Combination with Repetition - Problems  
Lecture 27 - Binomial theorem  
Lecture 28 - Applications of Binomial theorem  
Lecture 29 - Properties of Binomial theorem

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- Lecture 30 - Multinomial theorem
- Lecture 31 - Problems on Binomial theorem
- Lecture 32 - Pascal's Triangle
- Lecture 33 - Fun facts on Pascal's Triangle
- Lecture 34 - Catalan Numbers - Part 1
- Lecture 35 - Catalan Numbers - Part 2
- Lecture 36 - Catalan Numbers - Part 3
- Lecture 37 - Catalan Numbers - Part 4
- Lecture 38 - Examples of Catalan numbers
- Lecture 39 - Chapter Summary
- Lecture 40 - Introduction to Set Theory
- Lecture 41 - Example, definition and notation
- Lecture 42 - Sets - Problems Part 1
- Lecture 43 - Subsets - Part 1
- Lecture 44 - Subsets - Part 2
- Lecture 45 - Subsets - Part 3
- Lecture 46 - Union and intersections of sets
- Lecture 47 - Union and intersections of sets - Part 1
- Lecture 48 - Union and intersections of sets - Part 2
- Lecture 49 - Union and intersections of sets - Part 3
- Lecture 50 - Cardinality of Union of two sets - Part 1
- Lecture 51 - Cardinality of Union of two sets - Part 2
- Lecture 52 - Cardinality of Union of three sets
- Lecture 53 - Power Set - Part 1
- Lecture 54 - Power set - Part 2
- Lecture 55 - Power set - Part 3
- Lecture 56 - Connection between Binomial Theorem and Power Sets
- Lecture 57 - Power set - Problems
- Lecture 58 - Complement of a set
- Lecture 59 - De Morgan's Laws - Part 1
- Lecture 60 - De Morgan's Laws - Part 2
- Lecture 61 - A proof technique
- Lecture 62 - De Morgan's Laws - Part 3
- Lecture 63 - De Morgan's Laws - Part 4
- Lecture 64 - Set difference - Part 1
- Lecture 65 - Set difference - Part 2
- Lecture 66 - Symmetric difference
- Lecture 67 - History
- Lecture 68 - Summary

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- Lecture 69 - Motivational example
- Lecture 70 - Introduction to Statements
- Lecture 71 - Examples and Non-examples of Statements
- Lecture 72 - Introduction to Negation
- Lecture 73 - Negation - Explanation
- Lecture 74 - Negation - Truthtable
- Lecture 75 - Examples for Negation
- Lecture 76 - Motivation for OR operator
- Lecture 77 - Introduction to OR operator
- Lecture 78 - Truthtable for OR operator
- Lecture 79 - OR operator for 3 Variables
- Lecture 80 - Truthtable for AND operator
- Lecture 81 - AND operator for 3 Variables
- Lecture 82 - Primitive and Compound statements - Part 1
- Lecture 83 - Primitive and Compound statements - Part 2
- Lecture 84 - Problems involving NOT, OR and AND operators
- Lecture 85 - Introduction to implication
- Lecture 86 - Examples and Non-examples of Implication - Part 1
- Lecture 87 - Examples and Non-examples of Implication - Part 2
- Lecture 88 - Explanation of Implication
- Lecture 89 - Introduction to Double Implication
- Lecture 90 - Explanation of Double Implication
- Lecture 91 - Converse, Inverse and Contrapositive
- Lecture 92 - XOR operator - Part 1
- Lecture 93 - XOR operator - Part 2
- Lecture 94 - XOR operator - Part 3
- Lecture 95 - Problems
- Lecture 96 - Tautology, Contradiction - Part 1
- Lecture 97 - Tautology, Contradiction - Part 2
- Lecture 98 - Tautology, Contradiction - Part 3
- Lecture 99 - SAT Problem - Part 1
- Lecture 100 - SAT Problem - Part 2
- Lecture 101 - Logical Equivalence - Part 1
- Lecture 102 - Logical Equivalence - Part 2
- Lecture 103 - Logical Equivalence - Part 3
- Lecture 104 - Logical Equivalence - Part 4
- Lecture 105 - Motivation for laws of logic
- Lecture 106 - Double negation - Part 1
- Lecture 107 - Double negation - Part 2

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- Lecture 108 - Laws of Logic
- Lecture 109 - De Morgan's Law - Part 1
- Lecture 110 - De Morgan's Law - Part 2
- Lecture 111 - Rules of Inferences - Part 1
- Lecture 112 - Rules of Inferences - Part 2
- Lecture 113 - Rules of Inferences - Part 3
- Lecture 114 - Rules of Inferences - Part 4
- Lecture 115 - Rules of Inferences - Part 5
- Lecture 116 - Rules of Inferences - Part 6
- Lecture 117 - Rules of Inferences - Part 7
- Lecture 118 - Conclusion
- Lecture 119 - Introduction to Relation
- Lecture 120 - Graphical Representation of a Relation
- Lecture 121 - Various sets
- Lecture 122 - Matrix Representation of a Relation
- Lecture 123 - Relation - An Example
- Lecture 124 - Cartesian Product
- Lecture 125 - Set Representation of a Relation
- Lecture 126 - Revisiting Representations of a Relation
- Lecture 127 - Examples of Relations
- Lecture 128 - Number of relations - Part 1
- Lecture 129 - Number of relations - Part 2
- Lecture 130 - Reflexive relation - Introduction
- Lecture 131 - Example of a Reflexive relation
- Lecture 132 - Reflexive relation - Matrix representation
- Lecture 133 - Number of Reflexive relations
- Lecture 134 - Symmetric Relation - Introduction
- Lecture 135 - Symmetric Relation - Matrix representation
- Lecture 136 - Symmetric Relation - Examples and non examples
- Lecture 137 - Parallel lines revisited
- Lecture 138 - Number of symmetric relations - Part 1
- Lecture 139 - Number of symmetric relations - Part 2
- Lecture 140 - Examples of Reflexive and Symmetric Relations
- Lecture 141 - Pattern
- Lecture 142 - Transitive relation - Examples and non examples
- Lecture 143 - Antisymmetric relation
- Lecture 144 - Examples of Transitive and Antisymmetric Relation
- Lecture 145 - Antisymmetric - Graphical representation
- Lecture 146 - Antisymmetric - Matrix representation

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- Lecture 147 - Number of Antisymmetric relations
- Lecture 148 - Condition for relation to be reflexive
- Lecture 149 - Few notations
- Lecture 150 - Condition for relation to be reflexive
- Lecture 151 - Condition for relation to be reflexive
- Lecture 152 - Condition for relation to be symmetric
- Lecture 153 - Condition for relation to be symmetric
- Lecture 154 - Condition for relation to be antisymmetric
- Lecture 155 - Equivalence relation
- Lecture 156 - Equivalence relation - Example 4
- Lecture 157 - Partition - Part 1
- Lecture 158 - Partition - Part 2
- Lecture 159 - Partition - Part 3
- Lecture 160 - Partition - Part 4
- Lecture 161 - Partition - Part 5
- Lecture 162 - Partition - Part 6
- Lecture 163 - Motivational Example - 1
- Lecture 164 - Motivational Example - 2
- Lecture 165 - Commonality in examples
- Lecture 166 - Motivational Example - 3
- Lecture 167 - Example - 4 Explanation
- Lecture 168 - Introduction to functions
- Lecture 169 - Definition of a function - Part 1
- Lecture 170 - Definition of a function - Part 2
- Lecture 171 - Definition of a function - Part 3
- Lecture 172 - Relations vs Functions - Part 1
- Lecture 173 - Relations vs Functions - Part 2
- Lecture 174 - Introduction to One-One Function
- Lecture 175 - One-One Function - Example 1
- Lecture 176 - One-One Function - Example 2
- Lecture 177 - One-One Function - Example 3
- Lecture 178 - Proving a Function is One-One
- Lecture 179 - Examples and Non- examples of One-One function
- Lecture 180 - Cardinality condition in One-One function - Part 1
- Lecture 181 - Cardinality condition in One-One function - Part 2
- Lecture 182 - Introduction to Onto Function - Part 1
- Lecture 183 - Introduction to Onto Function - Part 2
- Lecture 184 - Definition of Onto Function
- Lecture 185 - Examples of Onto Function

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- Lecture 186 - Cardinality condition in Onto function - Part 1
- Lecture 187 - Cardinality condition in Onto function - Part 2
- Lecture 188 - Introduction to Bijection
- Lecture 189 - Examples of Bijection
- Lecture 190 - Cardinality condition in Bijection - Part 1
- Lecture 191 - Cardinality condition in Bijection - Part 2
- Lecture 192 - Counting number of functions
- Lecture 193 - Number of functions
- Lecture 194 - Number of One-One functions - Part 1
- Lecture 195 - Number of One-One functions - Part 2
- Lecture 196 - Number of One-One functions - Part 3
- Lecture 197 - Number of Onto functions
- Lecture 198 - Number of Bijections
- Lecture 199 - Counting number of functions.
- Lecture 200 - Motivation for Composition of functions - Part 1
- Lecture 201 - Motivation for Composition of functions - Part 2
- Lecture 202 - Definition of Composition of functions
- Lecture 203 - Why study Composition of functions
- Lecture 204 - Example of Composition of functions - Part 1
- Lecture 205 - Example of Composition of functions - Part 2
- Lecture 206 - Motivation for Inverse functions
- Lecture 207 - Inverse functions
- Lecture 208 - Examples of Inverse functions
- Lecture 209 - Application of inverse functions - Part 1
- Lecture 210 - Three stories
- Lecture 211 - Three stories - Connecting the dots
- Lecture 212 - Mathematical induction - An illustration
- Lecture 213 - Mathematical Induction - Its essence
- Lecture 214 - Mathematical Induction - The formal way
- Lecture 215 - MI - Sum of odd numbers
- Lecture 216 - MI - Sum of powers of 2
- Lecture 217 - MI - Inequality 1
- Lecture 218 - MI - Inequality 1 (solution)
- Lecture 219 - MI - To prove divisibility
- Lecture 220 - MI - To prove divisibility (solution)
- Lecture 221 - MI - Problem on satisfying inequalities
- Lecture 222 - MI - Problem on satisfying inequalities (solutions)
- Lecture 223 - MI - Inequality 2
- Lecture 224 - MI - Inequality 2 solution

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- Lecture 225 - Mathematical Induction - Example 9
- Lecture 226 - Mathematical Induction - Example 10 solution
- Lecture 227 - Binomial Coefficients - Proof by induction
- Lecture 228 - Checker board and Triominoes - A puzzle
- Lecture 229 - Checker board and triominoes - Solution
- Lecture 230 - Mathematical induction - An important note
- Lecture 231 - Mathematical Induction - A false proof
- Lecture 232 - A false proof - Solution
- Lecture 233 - Motivation for Pigeonhole Principle
- Lecture 234 - Group of n people
- Lecture 235 - Set of n integers
- Lecture 236 - 10 points on an equilateral triangle
- Lecture 237 - Pigeonhole Principle - A result
- Lecture 238 - Consecutive integers
- Lecture 239 - Consecutive integers solution
- Lecture 240 - Matching initials
- Lecture 241 - Matching initials - Solution
- Lecture 242 - Numbers adding to 9
- Lecture 243 - Numbers adding to 9 - Solution
- Lecture 244 - Deck of cards
- Lecture 245 - Deck of cards - Solution
- Lecture 246 - Number of errors
- Lecture 247 - Number of errors - Solution
- Lecture 248 - Puzzle - Challenge for you
- Lecture 249 - Friendship - an interesting property
- Lecture 250 - Connectedness through Connecting people
- Lecture 251 - Traversing the bridges
- Lecture 252 - Three utilities problem
- Lecture 253 - Coloring the India map
- Lecture 254 - Definition of a Graph
- Lecture 255 - Degree and degree sequence
- Lecture 256 - Relation between number of edges and degrees
- Lecture 257 - Relation between number of edges and degrees - Proof
- Lecture 258 - Hand shaking lemma - Corollary
- Lecture 259 - Problems based on Hand shaking lemma
- Lecture 260 - Havel Hakimi theorem - Part 1
- Lecture 261 - Havel Hakimi theorem - Part 2
- Lecture 262 - Havel Hakimi theorem - Part 3
- Lecture 263 - Havel Hakimi theorem - Part 4

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- Lecture 264 - Havel Hakimi theorem - Part 5
- Lecture 265 - Regular graph and irregular graph
- Lecture 266 - Walk
- Lecture 267 - Trail
- Lecture 268 - Path and closed path
- Lecture 269 - Definitions revisited
- Lecture 270 - Examples of walk, trail and path
- Lecture 271 - Cycle and circuit
- Lecture 272 - Example of cycle and circuit
- Lecture 273 - Relation between walk and path
- Lecture 274 - Relation between walk and path - An induction proof
- Lecture 275 - Subgraph
- Lecture 276 - Spanning and induced subgraph
- Lecture 277 - Spanning and induced subgraph - A result
- Lecture 278 - Introduction to Tree
- Lecture 279 - Connected and Disconnected graphs
- Lecture 280 - Property of a cycle
- Lecture 281 - Edge condition for connectivity
- Lecture 282 - Connecting connectedness and path
- Lecture 283 - Connecting connectedness and path - An illustration
- Lecture 284 - Cut vertex
- Lecture 285 - Cut edge
- Lecture 286 - Illustration of cut vertices and cut edges
- Lecture 287 - NetworkX - Need of the hour
- Lecture 288 - Introduction to Python - Installation
- Lecture 289 - Introduction to Python - Basics
- Lecture 290 - Introduction to NetworkX
- Lecture 291 - Story so far - Using NetworkX
- Lecture 292 - Directed, weighted and multi graphs
- Lecture 293 - Illustration of Directed, weighted and multi graphs
- Lecture 294 - Graph representations - Introduction
- Lecture 295 - Adjacency matrix representation
- Lecture 296 - Incidence matrix representation
- Lecture 297 - Isomorphism - Introduction
- Lecture 298 - Isomorphic graphs - An illustration
- Lecture 299 - Isomorphic graphs - A challenge
- Lecture 300 - Non-isomorphic graphs
- Lecture 301 - Isomorphism - A question
- Lecture 302 - Complement of a Graph - Introduction

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- Lecture 303 - Complement of a Graph - Illustration
- Lecture 304 - Self complement
- Lecture 305 - Complement of a disconnected graph is connected
- Lecture 306 - Complement of a disconnected graph is connected - Solution
- Lecture 307 - Which is more? Connected graphs or disconnected graphs?
- Lecture 308 - Bipartite graphs.
- Lecture 309 - Bipartite graphs
- Lecture 310 - Bipartite graphs - A puzzle
- Lecture 311 - Bipartite graphs - Converse part of the puzzle
- Lecture 312 - Definition of Eulerian Graph
- Lecture 313 - Illustration of Eulerian graph
- Lecture 314 - Non- example of Eulerian graph
- Lecture 315 - Litmus test for an Eulerian graph
- Lecture 316 - Why even degree?
- Lecture 317 - Proof for even degree implies graph is Eulerian
- Lecture 318 - A condition for Eulerian trail
- Lecture 319 - Why the name Eulerian
- Lecture 320 - Can you traverse all locations?
- Lecture 321 - Definition of Hamiltonian graphs
- Lecture 322 - Examples of Hamiltonian graphs
- Lecture 323 - Hamiltonian graph - A result
- Lecture 324 - A result on connectedness
- Lecture 325 - A result on Path
- Lecture 326 - Dirac's Theorem
- Lecture 327 - Dirac's theorem - A note
- Lecture 328 - Ore's Theorem
- Lecture 329 - Dirac's Theorem v/s Ore's Theorem
- Lecture 330 - Eulerian and Hamiltonian Are they related
- Lecture 331 - Importance of Hamiltonian graphs in Computer science
- Lecture 332 - Constructing non intersecting roads
- Lecture 333 - Definition of a Planar graph
- Lecture 334 - Examples of Planar graphs
- Lecture 335 -  $V - E + R = 2$
- Lecture 336 - Illustration of  $V - E + R = 2$
- Lecture 337 -  $V - E + R = 2$ ; Use induction
- Lecture 338 - Proof of  $V - E + R = 2$
- Lecture 339 - Famous non-planar graphs
- Lecture 340 - Litmus test for planarity
- Lecture 341 - Planar graphs - Inequality 1

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- Lecture 342 - 3 Utilities problem - Revisited
- Lecture 343 - Complete graph on 5 vertices is non-planar - Proof
- Lecture 344 - Prisoners and cells
- Lecture 345 - Prisoners example and Proper coloring
- Lecture 346 - Chromatic number of a graph
- Lecture 347 - Examples on Proper coloring
- Lecture 348 - Recalling the India map problem
- Lecture 349 - Recalling the India map problem - Solution
- Lecture 350 - NetworkX - Digraphs
- Lecture 351 - NetworkX - Adjacency matrix
- Lecture 352 - NetworkX - Random graphs
- Lecture 353 - NetworkX - Subgraph
- Lecture 354 - NetworkX - Isomorphic graphs Part 1
- Lecture 355 - NetworkX - Isomorphic graphs Part 2
- Lecture 356 - NetworkX - Isomorphic graphs
- Lecture 357 - NetworkX - Graph complement
- Lecture 358 - NetworkX - Eulerian graphs
- Lecture 359 - NetworkX - Bipartite graphs
- Lecture 360 - NetworkX - Coloring
- Lecture 361 - Counting in a creative way
- Lecture 362 - Example 1 - Fun with words
- Lecture 363 - Words and the polynomial
- Lecture 364 - Words and the polynomial - Explained
- Lecture 365 - Example 2 - Picking five balls
- Lecture 366 - Picking five balls - Solution
- Lecture 367 - Picking five balls - Another version
- Lecture 368 - Definition of Generating function
- Lecture 369 - Generating function examples - Part 1
- Lecture 370 - Generating function examples - Part 2
- Lecture 371 - Generating function examples - Part 3
- Lecture 372 - Binomial expansion - A generating function
- Lecture 373 - Binomial expansion - Explained
- Lecture 374 - Picking 7 balls - The naive way
- Lecture 375 - Picking 7 balls - The creative way
- Lecture 376 - Generating functions - Problem 1
- Lecture 377 - Generating functions - Problem 2
- Lecture 378 - Generating functions - Problem 3
- Lecture 379 - Why Generating function?
- Lecture 380 - Introduction to Advanced Counting

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Lecture 381 - Example 1  
Lecture 382 - Inclusion-Exclusion Formula  
Lecture 383 - Proof of Inclusion - Exclusion formula  
Lecture 384 - Example 2  
Lecture 385 - Example 3  
Lecture 386 - Example 4  
Lecture 387 - Example 5  
Lecture 388 - Example 6  
Lecture 389 - A tip in solving problems  
Lecture 390 - Example 7  
Lecture 391 - Example 8  
Lecture 392 - Example 10  
Lecture 393 - Example 11  
Lecture 394 - Example 11  
Lecture 395 - Example 12  
Lecture 396 - Number of Onto Functions.  
Lecture 397 - Formula for Number of Onto Functions  
Lecture 398 - Example 13  
Lecture 399 - Example 14  
Lecture 400 - Derangements  
Lecture 401 - Derangements of 4 numbers  
Lecture 402 - Example 15  
Lecture 403 - Example 16  
Lecture 404 - Example 17  
Lecture 405 - Example 18  
Lecture 406 - Example 19  
Lecture 407 - Placing rooks on the chessboard  
Lecture 408 - Rook Polynomial  
Lecture 409 - Rook Polynomial  
Lecture 410 - Motivation for recurrence relation  
Lecture 411 - Getting started with recurrence relations  
Lecture 412 - What is a recurrence relation?  
Lecture 413 - Compound Interest as a recurrence relation  
Lecture 414 - Examples of recurrence relations  
Lecture 415 - Example - Number of ways of climbing steps  
Lecture 416 - Number of ways of climbing steps  
Lecture 417 - Example - Rabbits on an island  
Lecture 418 - Example - n-bit string  
Lecture 419 - Example - n-bit string without consecutive zero

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- Lecture 420 - Solving Linear Recurrence Relations - A theorem
- Lecture 421 - A note on the proof
- Lecture 422 - Solving recurrence relation - Example 1
- Lecture 423 - Solving recurrence relation - Example 2
- Lecture 424 - Fibonacci Sequence
- Lecture 425 - Introduction to Fibonacci sequence
- Lecture 426 - Solution of Fibonacci sequence
- Lecture 427 - A basic introduction to 'complexity'
- Lecture 428 - Intuition for 'complexity'
- Lecture 429 - Visualizing complexity order as a graph
- Lecture 430 - Tower of Hanoi
- Lecture 431 - Recurrence relation of Tower of Hanoi
- Lecture 432 - Solution for the recurrence relation of Tower of Hanoi
- Lecture 433 - A searching technique
- Lecture 434 - Recurrence relation for Binary search
- Lecture 435 - Solution for the recurrence relation of Binary search
- Lecture 436 - Example
- Lecture 437 - Example
- Lecture 438 - Door knock example and Merge sort
- Lecture 439 - Introduction to Merge sort - 1
- Lecture 440 - Recurrence relation for Merge sort
- Lecture 441 - Introduction to advanced topics
- Lecture 442 - Introduction to Chromatic polynomial
- Lecture 443 - Chromatic polynomial of complete graphs
- Lecture 444 - Chromatic polynomial of cycle on 4 vertices - Part 1
- Lecture 445 - Chromatic polynomial of cycle on 4 vertices - Part 2
- Lecture 446 - Correspondence between partition and generating functions
- Lecture 447 - Correspondence between partition and generating functions
- Lecture 448 - Distinct partitions and odd partitions
- Lecture 449 - Distinct partitions and generating functions
- Lecture 450 - Odd partitions and generating functions
- Lecture 451 - Distinct partitions equals odd partitions
- Lecture 452 - Distinct partitions equals odd partitions
- Lecture 453 - Why 'partitions' to 'polynomial'?
- Lecture 454 - Example
- Lecture 455 - Motivation for exponential generating function
- Lecture 456 - Recurrence relation
- Lecture 457 - Introduction to Group Theory
- Lecture 458 - Uniqueness of the identity element

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- Lecture 459 - Formal definition of a Group
- Lecture 460 - Groups
- Lecture 461 - Groups
- Lecture 462 - Groups
- Lecture 463 - Subgroup
- Lecture 464 - Lagrange's theorem
- Lecture 465 - Summary
- Lecture 466 - Conclusion