

This report summarises the types of questions the past papers from 2020, 2021, 2022 (the online tests). Note, mastery questions are not included. Each number in the bracket indicates the number of marks this type of question appeared.

Chapter	Questions	Total Marks
Discrete Markov Chains	<ul style="list-style-type: none"> - Draw transition diagram (4) - sketch examples of realisations (2) - Basic properties: Irreducibility, time-reversibility etc. (12) - Judge if a chain is Markov chain (10) - Find transition matrix (9) - Find marginal distributions/probabilities (20) - Find and classify communicating classes (9) <ul style="list-style-type: none"> - Find the periods (1) - Judge recurrence of states (3) - Find stationary distributions (19) - Necessary conditions for existence of stationary distribution (10) - Find example of a DTMC satisfying some conditions (10) - Practical question: Explain feasibility, limits of a model (2) 	111 46.3%
Exponential Distribution	None	
Poisson Processes	<ul style="list-style-type: none"> - Practical question: construct/state a suitable Poisson Process (11) - Practical question: Explain feasibility, limits of a model (5) - Find some probability/quantity (6) - Find distribution/conditional distribution (23) - Find the rate of process given some information (4) - Judge if a process is Poisson process (9) 	58 24.2%
Continuous-time Markov Chains	<ul style="list-style-type: none"> - Practical question: define state space, transition rates (3) - Practical question: Find some probability/quantity (2) - Draw transition diagram (4) - Find holding time distribution (3) - Laplace transform, and use it to find expectation (4) - Find transition matrix of embedded jump chain (9) - Judge Recurrence/transience (5) - Simulation of CTMC by computer (3) - Find example of a CTMC satisfying some conditions (5) 	38 15.8%
Brownian motion	<ul style="list-style-type: none"> - Calculate Expectation variance or covariance of Brownian motions (13) 	13 5.4%
Others	<ul style="list-style-type: none"> - Finding expectation of some expression (7) - Prove an equation (7) - Judge independence of variables (6) 	20 8.3%
Total marks		240

Distribution of Marks by Question Type

Bookwork(writing down or using definitions from books):	5 (2.0%)
Draw Diagrams	10 (4.0%)
Calculation(mainly finding probabilities, or calculations on random variables):	147 (61.3%)
Example (find example of a Markov chain satisfying certain conditions)	17 (7.1%)
Logical Deductions/proofs:	51 (21.3%)
Explanation:	10 (4.2%)

Top Questions

- Find distributions for variables in Poisson process or Markov chains
- Find stationary distribution of DTMC
- Construct/State a Poisson process given a practical situation
- Judge if something (combination of some processes or chains) is a Markov chain/Poisson Process
- Find examples of Markov chains satisfying certain conditions