

# Contents

<b>1</b>	<b>Introduction</b>	<b>7</b>
1.1	Fibonacci numbers . . . . .	7
1.2	Difference equations . . . . .	9
1.3	The difference operator . . . . .	10
<b>2</b>	<b>Linear difference equations of first order</b>	<b>17</b>
2.1	Linear homogeneous difference equations of first order . . . . .	17
2.2	Linear inhomogeneous difference equations of first order . . . . .	18
<b>3</b>	<b>Linear difference equations of <math>n</math>-th order</b>	<b>29</b>
3.1	Linear homogeneous difference equations of $n$ -th order . . . . .	29
3.2	Linear inhomogeneous difference equations of $n$ -th order . . . . .	38
3.3	Linear homogeneous difference equations of $n$ -th order with constant coefficients . . . . .	42
3.4	Linear inhomogeneous difference equations of $n$ -th order with constant coefficients . . . . .	47
<b>4</b>	<b>Further solution methods</b>	<b>57</b>
4.1	Generating functions . . . . .	57
4.2	Decomposition of the operator . . . . .	61
<b>5</b>	<b>Non-linear difference equations</b>	<b>63</b>
5.1	Riccati difference equations . . . . .	63

5.2	Further difference equations that can be transformed into linear ones . . . . .	64
<b>6</b>	<b>Vector difference equations</b>	<b>69</b>
6.1	General vector difference equations . . . . .	69
<b>7</b>	<b>Linear vector difference equations of first order</b>	<b>71</b>
7.1	Linear homogeneous vector difference equations of first order .	71
7.2	Computation of $A^k$ . . . . .	76
7.3	Linear inhomogeneous vector difference equations of first order	79
<b>8</b>	<b>Stability</b>	<b>91</b>
8.1	Local stability analysis for autonomous discrete dynamical systems . . . . .	91
8.2	Stability conditions . . . . .	93
8.3	Periods and deterministic chaos . . . . .	97
8.4	Dynamical behaviour of Chebyshev polynomials . . . . .	100
8.5	Logistic growth and bifurcation . . . . .	103
<b>9</b>	<b>Applications</b>	<b>107</b>
9.1	Ideal population . . . . .	107
9.2	Sex-linked inheritance . . . . .	110
9.3	Markov chains . . . . .	113
9.4	Chemical reactions . . . . .	115
9.5	A predator-prey model . . . . .	117