

# Contents

<b>1</b>	<b>The Classification Theorem: Informal Presentation</b>	<b>1</b>
1.1	Introduction	1
1.2	Informal Presentation of the Theorem	4
	References	20
<b>2</b>	<b>Surfaces</b>	<b>21</b>
2.1	The Quotient Topology	21
2.2	Surfaces: A Formal Definition	23
	References	25
<b>3</b>	<b>Simplices, Complexes, and Triangulations</b>	<b>27</b>
3.1	Simplices and Complexes	27
3.2	Triangulations	32
	References	35
<b>4</b>	<b>The Fundamental Group, Orientability</b>	<b>37</b>
4.1	The Fundamental Group	37
4.2	The Winding Number of a Closed Plane Curve	42
4.3	The Fundamental Group of the Punctured Plane	45
4.4	The Degree of a Map in the Plane	46
4.5	Orientability of a Surface	47
4.6	Surfaces with Boundary	48
	References	51
<b>5</b>	<b>Homology Groups</b>	<b>53</b>
5.1	Finitely Generated Abelian Groups	53
5.2	Simplicial and Singular Homology	57
5.3	Homology Groups of the Finite Polyhedra	73
	References	77
<b>6</b>	<b>The Classification Theorem for Compact Surfaces</b>	<b>79</b>
6.1	Cell Complexes	79
6.2	Normal Form for Cell Complexes	83

6.3	Proof of the Classification Theorem .....	94
6.4	Connected Sums and the Classification Theorem .....	95
6.5	Other Combinatorial Proofs .....	97
6.6	Application of the Main Theorem: Determining the Fundamental Groups of Compact Surfaces .....	99
	References .....	102
<b>A</b>	<b>Viewing the Real Projective Plane in <math>\mathbb{R}^3</math>; The Cross-Cap and the Steiner Roman Surface .....</b>	<b>105</b>
	References .....	112
<b>B</b>	<b>Proof of Proposition 5.1 .....</b>	<b>113</b>
<b>C</b>	<b>Topological Preliminaries .....</b>	<b>117</b>
C.1	Metric Spaces and Normed Vector Spaces .....	117
C.2	Topological Spaces, Continuous Functions, Limits .....	121
C.3	Connected Sets .....	129
C.4	Compact Sets .....	136
	References .....	149
<b>D</b>	<b>History of the Classification Theorem .....</b>	<b>151</b>
	References .....	157
<b>E</b>	<b>Every Surface Can Be Triangulated .....</b>	<b>159</b>
	References .....	165
<b>F</b>	<b>Notes .....</b>	<b>167</b>
	References .....	172
	<b>Symbol Index .....</b>	<b>173</b>
	<b>Index .....</b>	<b>175</b>

A Guide to the Classification Theorem for Compact  
Surfaces

Gallier, J.; Xu, D.

2013, XII, 178 p. 78 illus., 20 illus. in color., Hardcover

ISBN: 978-3-642-34363-6