# Solutions to John Milnor and James Stasheff's $Characteristic\ Classes$

Patrick Borse

Abstract. This docu	ument contains solutions to	o the problems of Joh	n Milnor and James S	Stasheff's Char-

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### Smooth Manifolds

- Problem 1.1.
- Problem 1.2.
- Problem 1.3.

### Vector Bundles

- Problem 2.1.
- Problem 2.2.
- Problem 2.3.
- Problem 2.4.
- Problem 2.5.
- Problem 2.6.

### Constructing New Vector Bundles Out of Old

- Problem 3.1.
- Problem 3.2.
- Problem 3.3.
- Problem 3.4.
- Problem 3.5.
- Problem 3.6.

### Stiefel-Whitney Classes

- Problem 4.1.
- Problem 4.2.
- Problem 4.3.
- Problem 4.4.
- Problem 4.5.

### Grassmannian Manifolds and Universal Bundles

- Problem 5.1.
- Problem 5.2.
- Problem 5.3.
- Problem 5.4.
- Problem 5.5.

### A Cell Structure for Grassmannian Manifolds

- Problem 6.1.
- Problem 6.2.
- Problem 6.3.
- Problem 6.4.
- Problem 6.5.

# The Cohomology Ring $H^*(G_n; \mathbf{Z}/2\mathbf{Z})$

- Problem 7.1.
- Problem 7.2.
- Problem 7.3.

# Existence of Stiefel-Whitney Classes

Problem 8.1.

Problem 8.2.

### Oriented Bundles and the Euler Class

- Problem 9.1.
- Problem 9.2.
- Problem 9.3.

### Computations in a Smooth Manifold

- Problem 11.1.
- Problem 11.2.
- Problem 11.3.
- Problem 11.4.
- Problem 11.5.
- Problem 11.6.

### Obstructions

- Problem 12.1.
- Problem 12.2.
- Problem 12.3.
- Problem 12.4.

### Complex Vector Bundles and Complex Manifolds

- Problem 13.1.
- Problem 13.2.
- Problem 13.3.
- Problem 13.4.
- Problem 13.5.
- Problem 13.6.
- Problem 13.7.

### Chern Classes

- Problem 14.1.
- Problem 14.2.
- Problem 14.3.
- Problem 14.4.
- Problem 14.5.

# Pontrjagin Classes

- Problem 15.1.
- Problem 15.2.
- Problem 15.3.
- Problem 15.4.

### Chern Numbers and Pontrjagin Numbers

- Problem 16.1.
- Problem 16.2.
- Problem 16.3.
- Problem 16.4.
- Problem 16.5.
- Problem 16.6.

# Thom Spaces and Transversality

Problem 18.1.

### Multiplicative Sequences and the Signature Theorem

Problem 19.1.

Problem 19.2.

Problem 19.3.

# Combinatorial Pontrjagin Classes

Problem 20.1.

### APPENDIX A

# Singular Homology and Cohomology

Problem A.1.

Problem A.2.

#### APPENDIX B

### Bernoulli Numbers

- Problem B.1.
- Problem B.2.
- Problem B.3.
- Problem B.4.