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Integration and Harmonic Analysis on Compact Groups

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General Introduction

This set of notes is the result of fusing two sets of skeletal notes, one headed 'The Riesz representation theorem' and the other 'Harmonic analysis on compact groups', the aim being to end up with a reasonably self-contained introduction to portions of analysis on compact spaces and, more especially, on compact groups.

The term 'introduction' requires emphasis. These notes are not (and cannot be) expected to do much more than convey a general picture, even though a few aspects are treated in some detail. In particular, a good many proofs easily accessible in standard texts have been omitted; and many of the proofs included are presented in a somewhat condensed form and may require further attention from readers who decide to study in more detail the areas under discussion. These features arise from a deliberate attempt to avoid too much detail; they are also to some extent inevitable consequences of an attempt to survey rapidly a fairly large body of material.

The substructure of Part 2 has (I am told) been found useful as a lead-in by research students whose subsequent interest has been in specialised topics in harmonic analysis. Part 1 has, I think, filled a similar role in relation to abstract integration theory. If the readers have been attracted by the topics presented, they have pressed on to study some of the more detailed items listed in the bibliography. (In respect of Part 2, there is little doubt that the second volume of Hewitt and Ross [1] is the main follow-up to these notes.) It is hoped that the present fusion will be more helpful than either of the original sets of notes could have been when taken singly.

There are reasonable grounds for this hope, insofar as little depth in problems of harmonic analysis can be achieved without a suitable integration theory. This is the case, notwithstanding what is written in Edwards [4] to suggest that a grasp of some of the fundamental problems demands no more than a relatively primitive concept of integration; for, as was pointed out there, further pursuit of these problems usually demands a fully-fledged Lebesgue-type integration theory. Thus Part 1 goes some way to furnishing the needs of Part 2, as well as constituting the foundation for numerous other topics in abstract analysis.

To mark the end of subsections of the text, in cases where it is perhaps not otherwise obvious that the end has been reached, the 'box' symbol □ has been used.

Acknowledgements

Part 1 is a modified version of notes prepared for use in a reading course in the School of General Studies in or around 1963, and I am grateful to the students who took that course for helping to clarify the exposition. (Most of the modifications made to Part 1 are such as to make it blend more harmoniously with Part 2; for any shortcomings involved in these modifications the said students naturally are in no way responsible.)

Part 2, the major component, amounts to a considerably modified and expanded version of some skeletal notes first prepared for use at Birkbeck College, University of London, in or around 1956. Interim and relatively minor revisions to these basic notes were made in May, 1964 with the help of Dr. Garth Gaudry, and again in November, 1968 with the help of Dr. John Price. As to the present revision, Dr. Price read and criticised most ably the almost-final version of Parts 1 and 2 up to Section 2.12, together with most of the Appendices. Many of his suggestions have been incorporated in the final version as it now appears. Miss Lyn Butler contributed handsomely by checking some of the exercises.

Mr. Walter Bloom has kindly indicated a number of misprints and errors in the first printing.

To Drs Gaudry and Price, Miss Butler and Mr. Bloom I express sincere thanks. The editor, Dr. M. F. Newman, earns my gratitude for his constant readiness to discuss questions of general layout and strategy.

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