Master of Science in Mathematical and Theoretical Physics

String Theory I

Write a report on the following topic:

- **Light-cone quantisation of the bosonic string.**

Your report must explain why space-time Lorentz invariance requires $a = 1$ and why the space time dimension $D = 26$. Describe the construction of physical states, including the no-ghost theorem and the spectrum generating algebra (see the book by Green, Schwarz and Witten for example, for the meaning of this). Give an analysis of the spectrum to at least level 2.

Original references are, for example:

- Goddard, Goldstone, Rebbi and Thorn, *"Quantum dynamics of a massless relativistic string"*, Nucl Phys **B56**, 109 (1973).
- Del Giudice, Di Vecchia and Fubini, *"General properties of the dual resonance model"*, Ann. Phys. **70**, 378, (1972).

The light cone quantisation of the bosonic string is described in many textbooks. Good examples are:

- Green, Schwarz and Witten Vol 1, Section 2.3. This reference is a good starting point and contains material you can try to cover.
- Blumenhagen, Lüst and Theisen, *Basic concepts in string theory*, Sections 3.1 and 3.3

You should make appropriate attribution for all of your sources. Your report should not merely be a repetition of standard textbook treatments and include if possible original research papers. Your report need not contain original research.

The report should be ten to fifteen pages in length in an 11 point font with one inch margins.