Abstract:

Many issues encountered in the area of capital investment could also be of discrete and combinatorial type. One procedure which might be very effective for solving such combinatorial problems is to formulate them as integer-linear programming problems.

Generally in a typical capital budgeting problem, decisions involve the selection of varieties of potential investments. The investment decisions might be to choose among possible plant locations, to select a configuration of capital equipment, or to settle upon a set of research-and-development projects.

In this initial description, I will present a selected topic about bond investment, which I think could be approached by integer programming techniques in some measure.

Introduction:

Bonds are loans that companies and governments issue to raise money. And like all loans, the borrower (the company or the government) pays interest to the lender (the investor who purchases the bond). It makes sense to have an investment strategy when it comes to bonds. It is good to diversify: Do not put all our money into one type of bond, or into one area. It is good to invest in different types of bonds, also including the shorter terms' and long terms'. It is also good to be aware of staggering our investments, so that we will have bonds maturing at different times; even different bonds might have different maturity length in reality.

Prototype of the related I.L.P. formulations:

I. Objective:
With limited budget in hand, we need to figure out the investment plan through the entire period of investment which would maximize the amount of budget we could accumulate by the end.

II. Data:
Most of the related data, i.e. the annual growth rate, and the maturity length of bond would be provided during the trading; even they could be obtained from trading consultants. We could also refer to historical information so that we could handle the uncertainty and risk appropriately.

III. Constraints:
- Limited on the total funds available;
- The choice of bonds: there are limits on how we can invest our money; suppose for some political reasons, we have to invest on some specified bonds (issued by the government?) if we would like to get money-making started; probably they should be invested above some indicated volume, or they should occupied as a

fixed quantity of our total investment.

- There may be some special types of bonds: for example, the profit we gained from some short-term bonds might be less than that of some long-term bonds; since our budget in hand would be varied year from year, and our life of investment is limited, this factor would also be taken in account on our plan.
- We might note that in an event of a loss by some investments, we might lose some of our money; even some kinds of portfolio would increase the risk of loss; this is a pity fact, so we would try to set limit on expected capital losses.
- While investing on some bonds, we might be asked for some fixed pre-payment, which could be treated as 0-1 restrictions on the related variables.