Capital Budgeting Problems (Exercises)

Football Team Creation

Coach Lombardi is trying to choose the starting line-up for his five-a-side football team. The team consists of seven players who have been rated (on a scale of 1 = poor to 3 = excellent) according to their ball-handling, shooting, tackling, and defensive abilities. The positions that each player is allowed to play and the player's abilities are listed in the table.

Player	Position	Ball-Handling	Shooting	Tackling	Defence
1	B	3	3	1	3
2	C	2	1	3	2
3	B-F	2	3	2	2
4	F-C	1	3	3	1
5	B-F	3	3	3	3
6	F-C	3	1	2	3
7	B-F	3	2	2	1

The five-player starting line-up must satisfy the following restrictions:

- At least four team members must be able to play backfield, at least two members must be able to play forward, and at least one member must be able to play centre.
- The average ball-handling, shooting, and tackling level of the starting line-up must be at least 2.
- If player 3 starts, then player 6 cannot start.
- If player 1 starts, then players 4 and 5 must both start.
- Either player 2 or player 3 must start.

Given these constraints, Coach Lombardi wants to maximise the total defensive ability of the starting team.

1. Formulate an Integer Programming Model that will solve the requirements of the Football Team.
2. Solve the formulated Integer Programming Model using Solver.
3. Solve the formulated Integer Programming Model using the Branch & Bound Simplex Algorithm.
4. Solve the formulated Integer Programming Model using the Cutting Plane Algorithm.

Aqualonia's Currency

The tiny island country of Aqualonia's currency system contains coins for the denominations 1¢, 5¢, 10¢, 20¢, 25¢, and 50¢. You have taken a holiday job at a convenience store in Aqualonia and must give a customer 91¢ in change.

1. Formulate an Integer Programming Model that will solve the requirements of the Aqualonia's Currency.
2. Solve the formulated Integer Programming Model using Solver.

3. Solve the formulated Integer Programming Model using the Branch & Bound Simplex Algorithm.
4. Solve the formulated Integer Programming Model using the Cutting Plane Algorithm.