Digital Technologies and Value Creation (Lecturer: Philippe Blaettchen) – Integer Programming Exercises

For each of the following situations:
1. What are the decision variables?
2. What are the constraints?
3. What is the objective?
4. Write down the corresponding optimization problem
5. Solve the optimization problem using Excel Solver

Make sure that the objective is a linear functions and that the constraints are either linear or integer/binary!

Situation 1

A cargo plane has three compartments for storing cargo: front, center, and back. These compartments have capacity limits on both weight and space as summarized below:

Compartment	Weight Capacity (tons)	Space capacity (ft^3)
Front	12	7,000
Center	18	9,000
Back	10	5,000

Units of the following four cargoes have been offered for shipment on an upcoming flight:

Cargo	Weight (tons)	Volume (ft^3)	Profit ($/ton)
1	2.0	1,000	320
2	1.6	1,150	400
3	2.5	1,400	360
4	1.3	780	290

How many units of each cargo should be accepted? How should the units be distributed among the compartments to maximize the total profit for the flight?

Situation 2

A venture capital firm is considering investments into 6 different projects. Each project has an initial cost, an expected profit rate (one year from now) expressed as a percentage of the initial cost, and an associated risk of failure. These numbers are given below:

	P1	P2	P3	P4	P5	P6
Initial cost (in M)	1.3	0.8	0.6	1.8	1.2	2.4
Profit rate (in %)	10	20	20	10	10	10

| Failure risk (in %) | 6 | 4 | 6 | 5 | 5 | 4 |

Which projects should the venture capital firm pick so as to maximize total expected profit, while investing no more than 4M and keeping its average failure risk below 5%?