VG441 Problem Set 3

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Problem 1

1. Formulate the set cover problem as a MILP

Decision Variables:
Our choices of sets: $x_i \in \{0,1\}, \quad i \in \{1,2,...,m\}$.
elements and sets: $s_{mn} \in \{0,1\}$, if set m has element n of V, then $s_{mn} = 1$, otherwise $s_{mn} = 0$
Objective:
Minimize $\sum_m^1 x_i$
Constraints:
$(SX)_n \geq 1$ for $\forall n$
$\sum_1^m x_i \geq 1$

2. Solve the problem on Page 4 of LEC015 using Gurobi

After running the gurobi codes, we get the solution that:

```
Gurobi Optimizer version 9.1.2 build v9.1.2rc0 (linux64)
Thread count: 4 physical cores, 8 logical processors,
using up to 8 threads
Optimize a model with 8 rows, 5 columns and 13 nonzeros
Model fingerprint: 0x8fe9a7d4
Coefficient statistics:
Matrix range     [1e+00, 1e+00]
Objective range  [1e+00, 1e+00]
Bounds range     [0e+00, 0e+00]
RHS range        [1e+00, 1e+00]
Presolve removed 8 rows and 5 columns
Presolve time: 0.00s
Presolve: All rows and columns removed
Iteration    Objective       Primal Inf.    Dual Inf.      Time
0    4.0000000e+00   0.000000e+00   0.000000e+00      0s

Solved in 0 iterations and 0.00 seconds
Optimal objective  4.000000000e+00

Variable            X
```

```
21 ------------------------------
22 decision var[0]              1
23 decision var[2]              1
24 decision var[3]              1
25 decision var[4]              1
26
27 Process finished with exit code 0
```

Therefore, the solution is: we choose set 1, 3, 4, 5