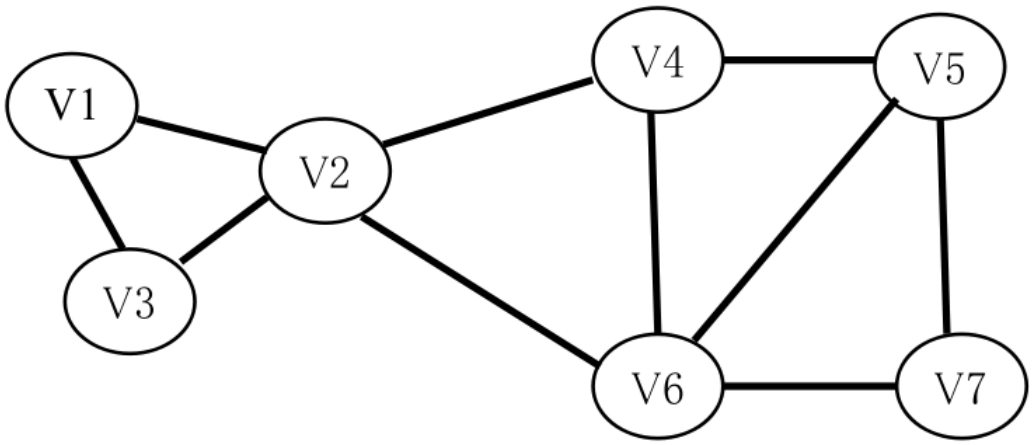
Design Technologies for Integrated Systems – EPFL

Exercise 1 **27 September 2018**

Problem 1

Given the graph $G(V, E)$ below:



(a) Show a minimum clique cover.

(b) Draw the complement graph.

(c) Color the complement graph with the smallest number of colors.

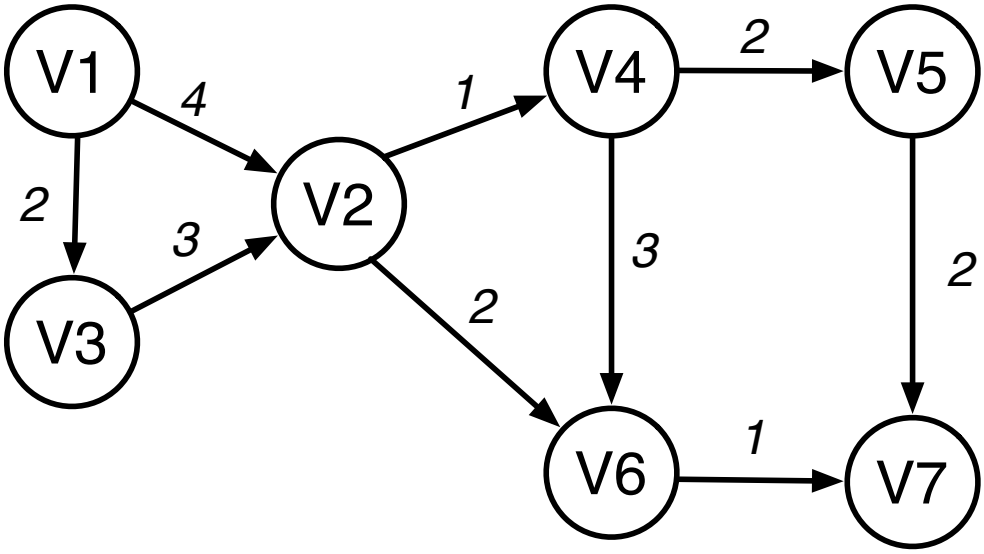
Problem 2

See the *Direct Acyclic Graph* (DAG) $G(V, E, W)$ below.

Consider vertex V_1 as the source and vertex V_7 as the sink. Find the shortest path from V_1 to V_7 by applying the following algorithms:

(a) Dijkstra algorithm.

(b) Bellman-Ford algorithm.



Problem 3

Given the following function: $F = ab + a'c + a'b'c'$

(a) Write the truth table.

(b) Show the vertexes of the cube where the function is true and circle the min-terms of the function F.

Problem 4

Given the following three peaces of pseudo-code:

Write the Control-Flow Expression that executes the three programs in parallel.

Code 1:

```
while a {
        while b {
                if (c)
                        P1
                else
                        P2
        }
        P3
}
```

Code 2:

```
wait d {
        a
}
```

Code 3:

```
wait e {
        a
}
```

Problem 5

Given the following equations:

$$
\begin{aligned}
x_1 &= (a + 3); \\
x_2 &= b; \\
x_3 &= (3 \times c); \\
x_4 &= (d + e); \\
x &= 3 + x_1 + x_2 + x_3 \times x_4 + 2;
\end{aligned}
$$

(a) Apply variable propagation and draw the data-flow graph (Inputs are $[a, b, c, d, e]$ and the output is x). Assume all additions and multiplications can have only 2 inputs.

(b) Apply tree height reduction on the data-flow graph from point (a).

(c) Apply constant propagation and operator strength reduction. Draw the resulting data-flow graph.