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 three pieces of pseudo-code:

Code 1:

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

Code 2:

```
wait d {
    a
}
```

Code 3:

```
wait e {
    a
}
```

Write the Control-Flow Expression that executes the three programs in parallel.
Problem 4

Given the following equations:

\[
x_1 = (a + 3);
\]

\[
x_2 = b;
\]

\[
x_3 = (3 \times c);
\]

\[
x_4 = (d + e);
\]

\[
x = 3 + x_1 + x_2 + x_3 \times x_4 + 2;
\]

(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.