LO1:

a) $\{\{1\}, \{3,4\}, \{1,3,5\}\} \notin P(\{1,2,3,4,5\})$

The powerset of a subset contains all possible subsets of a set, so while $P(\{1,2,3,4,5\})$ would contain $\{1\}$, $\{3,4\}$, and $\{1,3,5\}$, it would not contain the set of those sets.

$f(17) = \{1, 17\}$

$f(68) = \{1, 2, 4, 17, 34, 68\}$

b) i) (x_1, x_2): $\bar{x}_1 \to x_2$, $\bar{x}_2 \to x_1$

(x_1, x_6): $\bar{x}_1 \to x_6$, $\bar{x}_6 \to x_1$

$(\bar{x}_1, \bar{x}_2)$: $x_1 \to \bar{x}_2$, $x_2 \to \bar{x}_1$

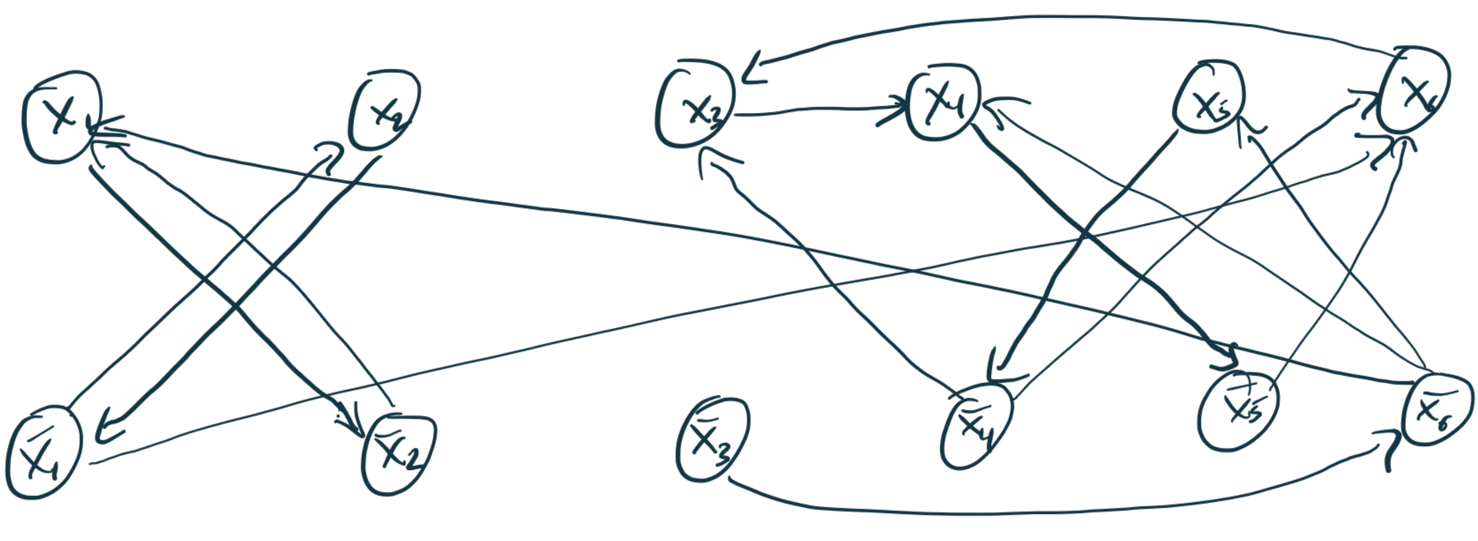
$(x_3, \bar{x}_6)$: $\bar{x}_3 \to \bar{x}_6$, $x_6 \to x_3$

$(\bar{x}_3, x_4)$: $x_3 \to x_4$, $\bar{x}_4 \to x_3$

$(\bar{x}_4, \bar{x}_5)$: $x_4 \to \bar{x}_5$, $x_5 \to \bar{x}_4$

(x_4, x_6): $\bar{x}_4 \to x_6$, $\bar{x}_6 \to x_4$

(x_5, x_6): $\bar{x}_5 \to x_6$, $\bar{x}_6 \to x_5$

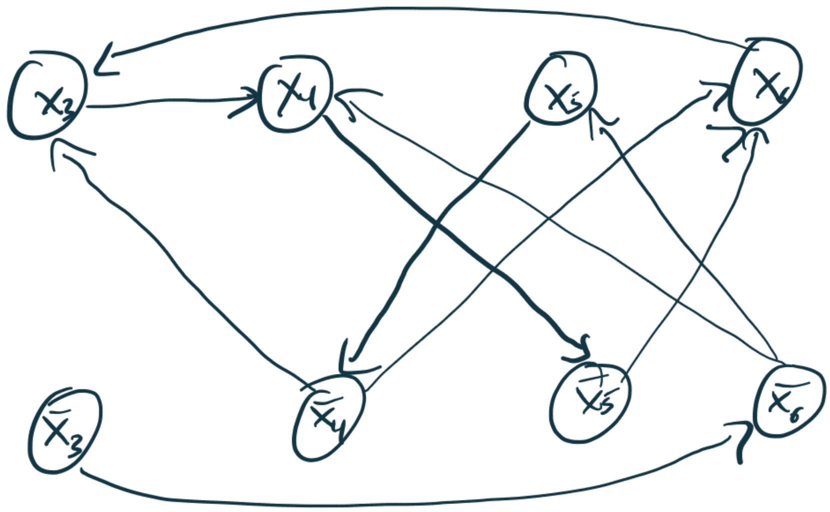


ii) $R_{x_1} = \{x_1, \overline{x_2}\}$ this is consistent, so we assign and reduce the graph

$x_1 = 1$

$x_2 = 0$

Reduced Graph:



$R_{x_3} = \{x_3, x_4, \overline{x_5}, x_6\}$ this is consistent, so we assign, and get our final satisfying assignment.

$x_3 = x_4 = x_6 = 1$

$x_5 = 0$

$$\boxed{\alpha = \{1, 0, 1, 1, 0, 1\}}$$

LO2:

a) A mapping reduction from Problem A to Problem B means for any positive instance of problem A, it will turn it into a positive instance of Problem B; any negative instance of problem A will be turned into a negative instance of Problem B.

b) $sum(S) = 36$ → Subset Sum Instance:

$t = 36/2 = 18$

$t = 18 \quad S = \{1, 3, 6, 10, 16\}$

c) f makes it so both problems are asking the same question by setting t to sum(S)/2. If we can find a subset equal to t, we will always be able to split the set into two parts with equal sum, making both instances positive. If we cannot find a subset equal to t, we won't be able to split the set, making both instances negative. Therefore, f is a valid mapping reduction.