



University at Buffalo

Center for Hybrid Rocket
Exascale Simulation Technology

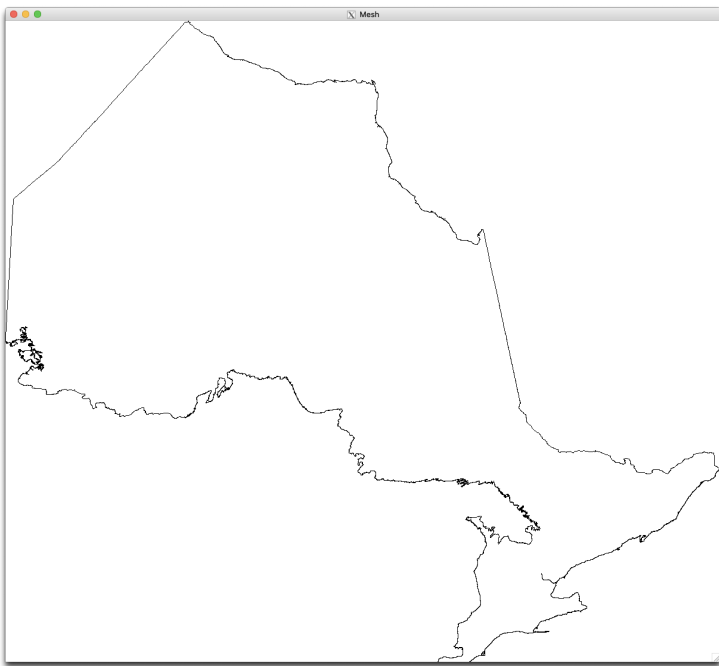


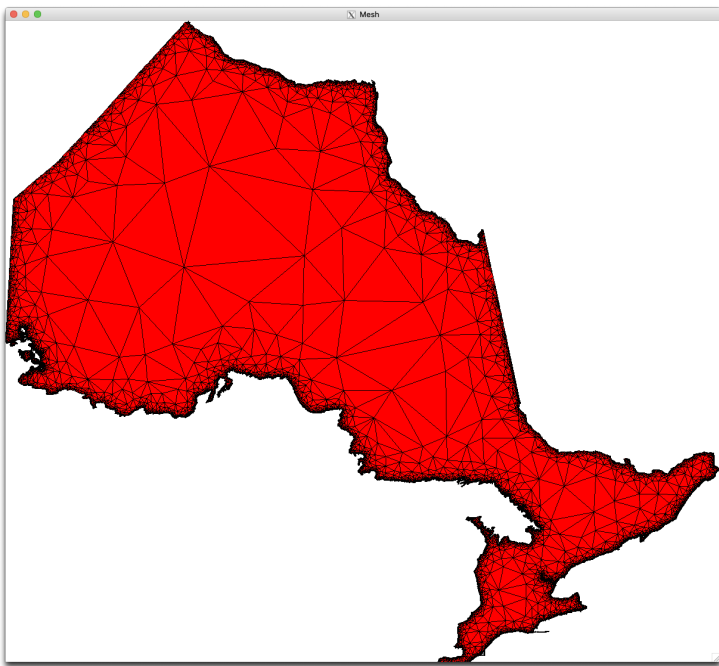
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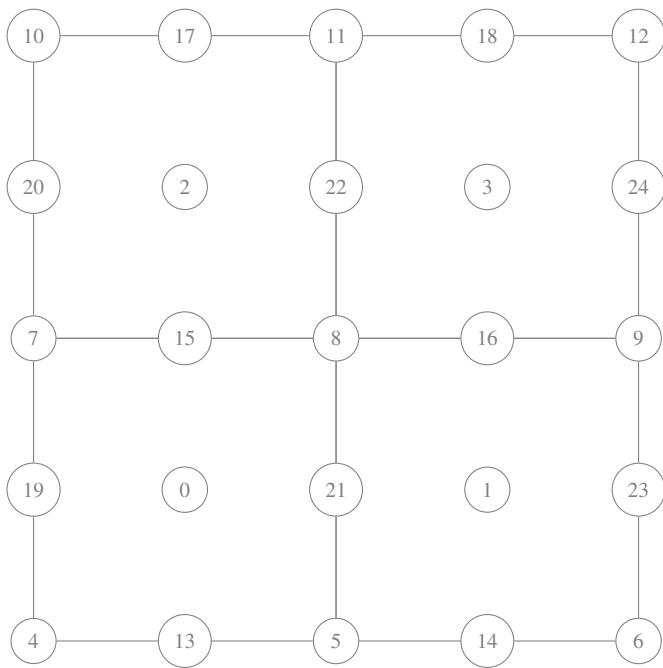
Center for Hybrid Rocket

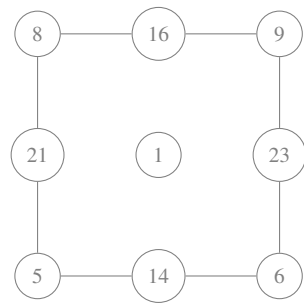
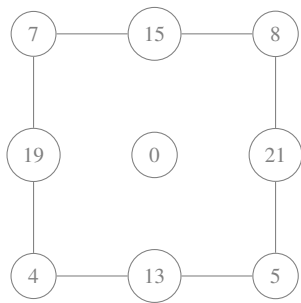
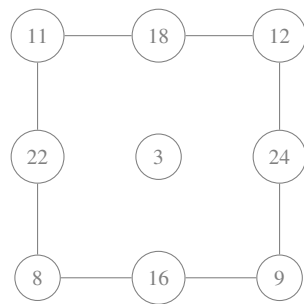
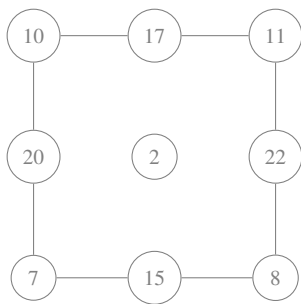
Exascale Simulation Technology

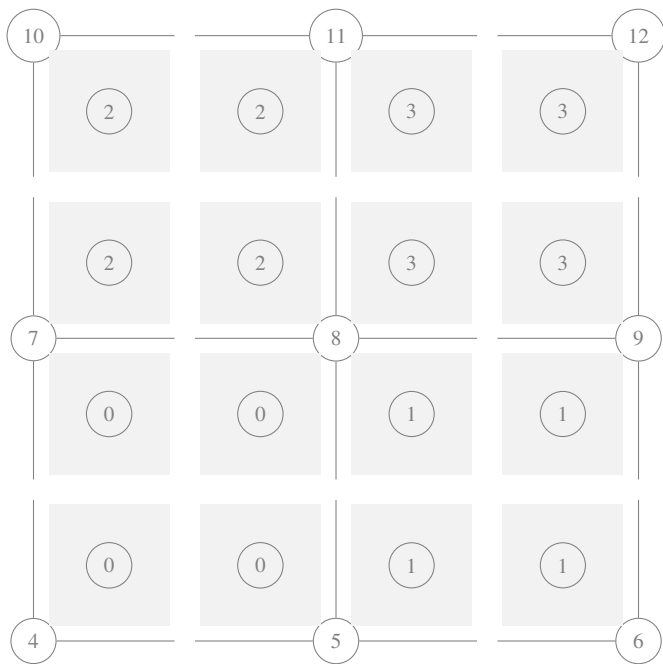


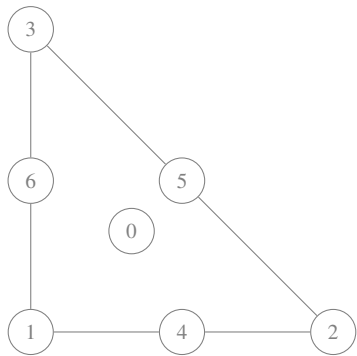


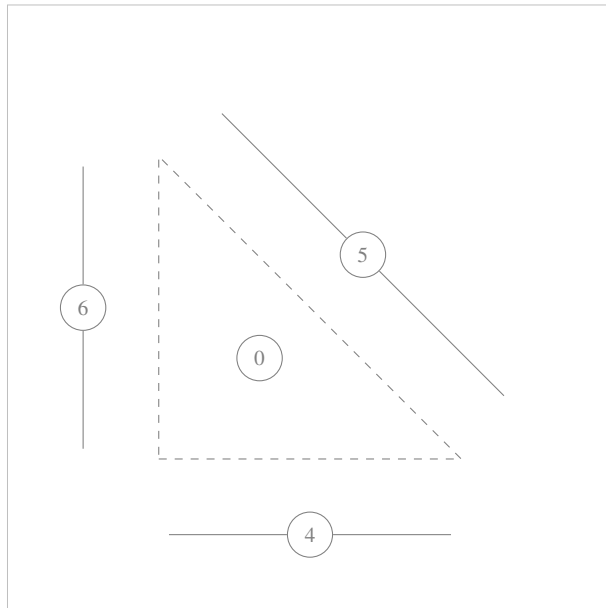


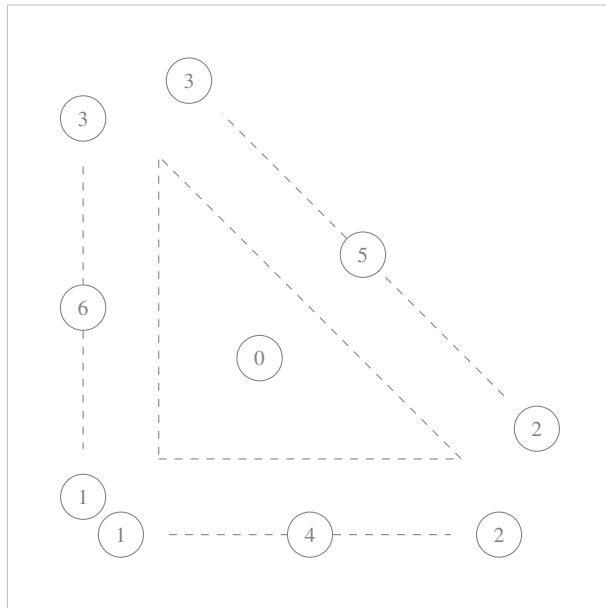




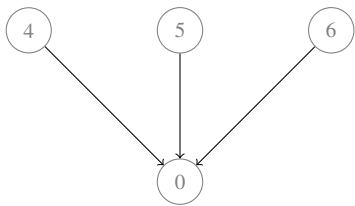


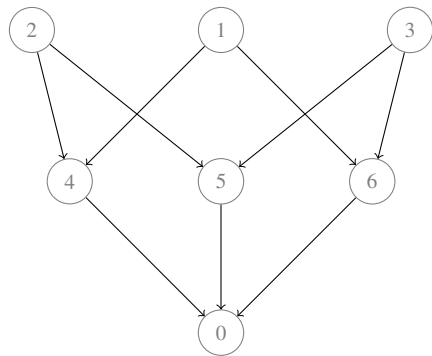


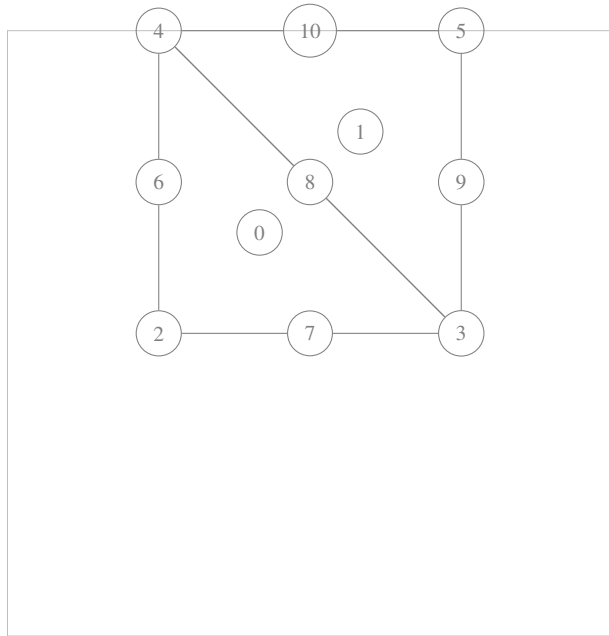


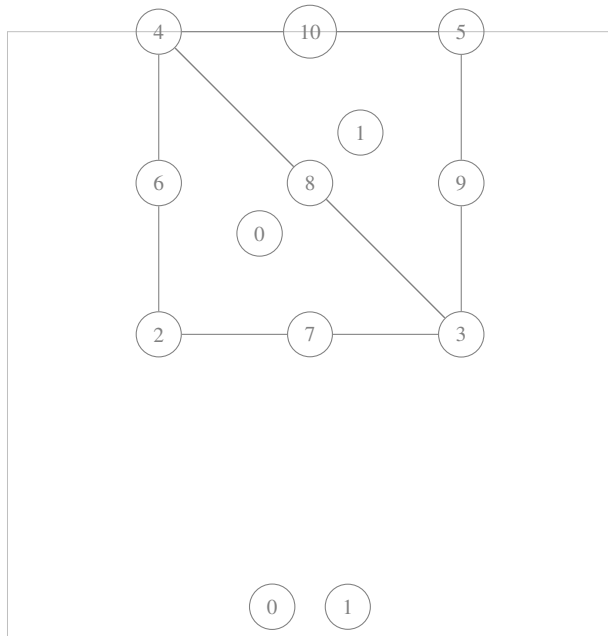


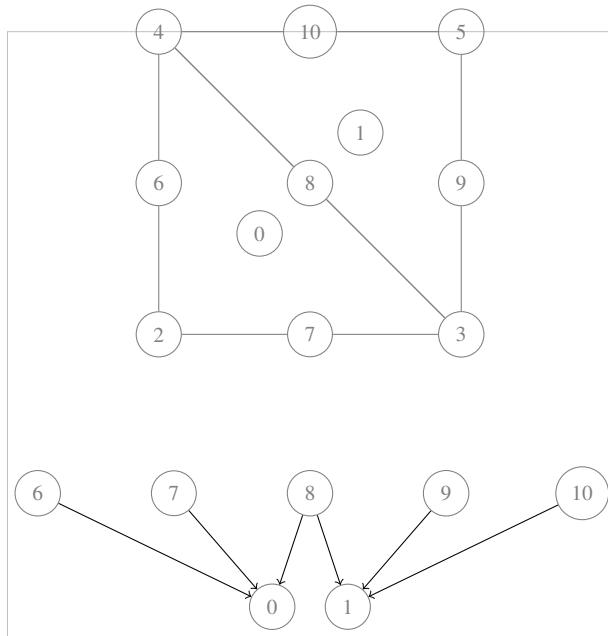
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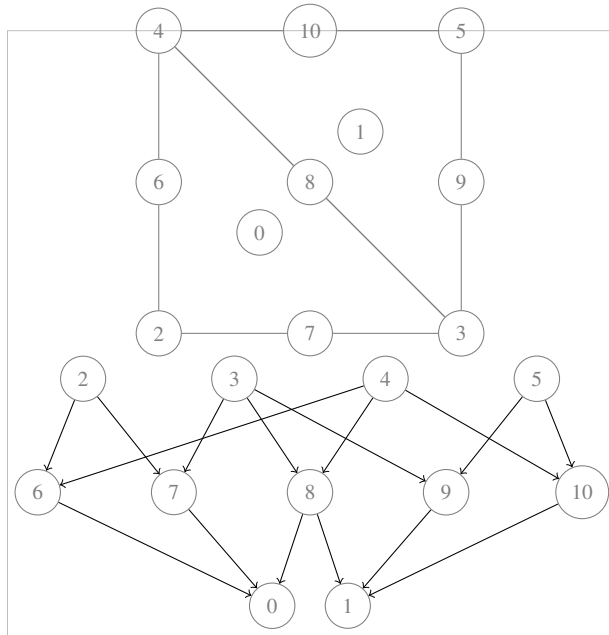


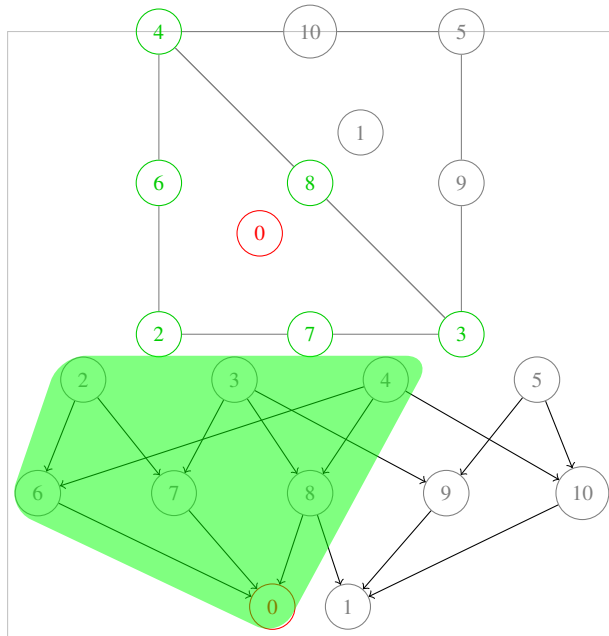


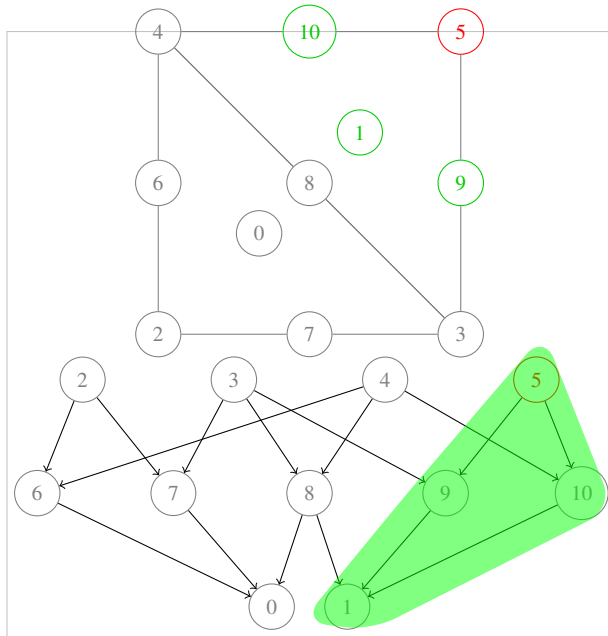


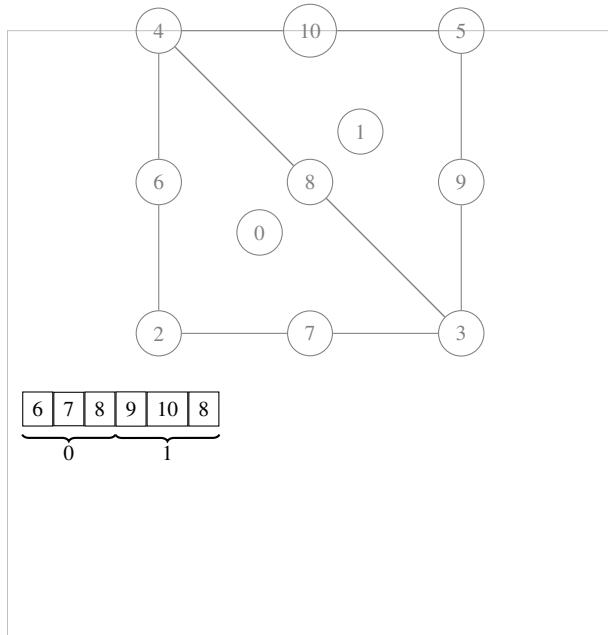


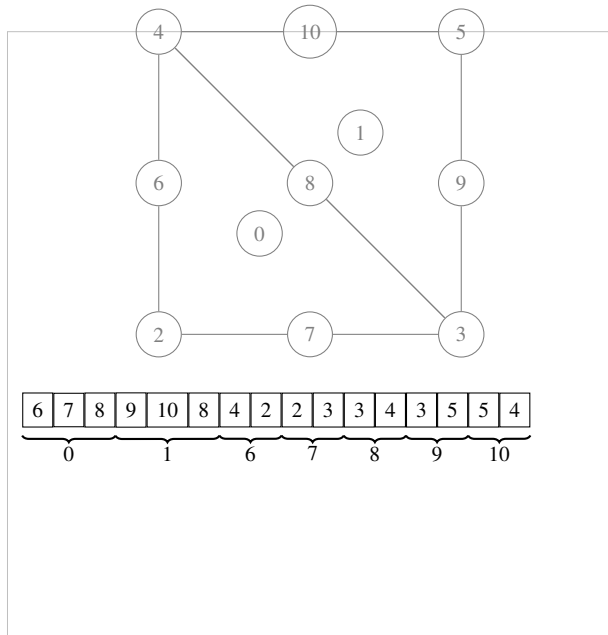


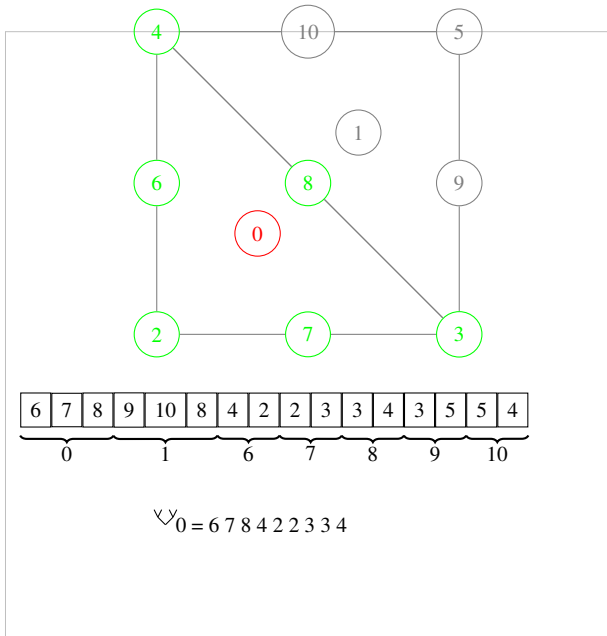


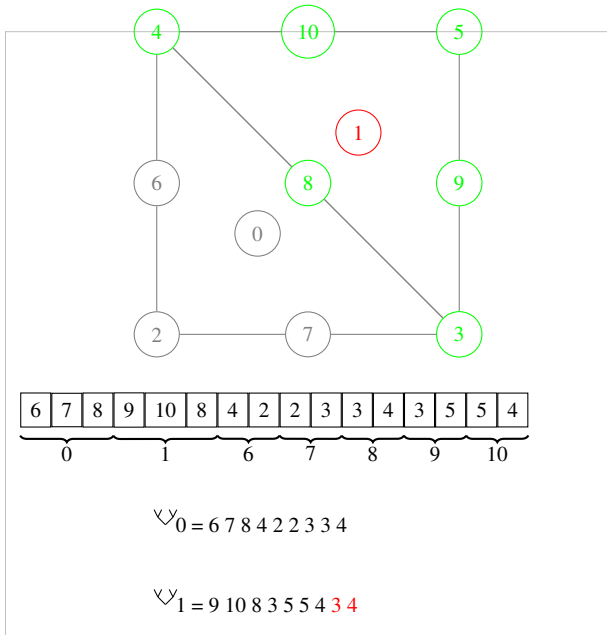


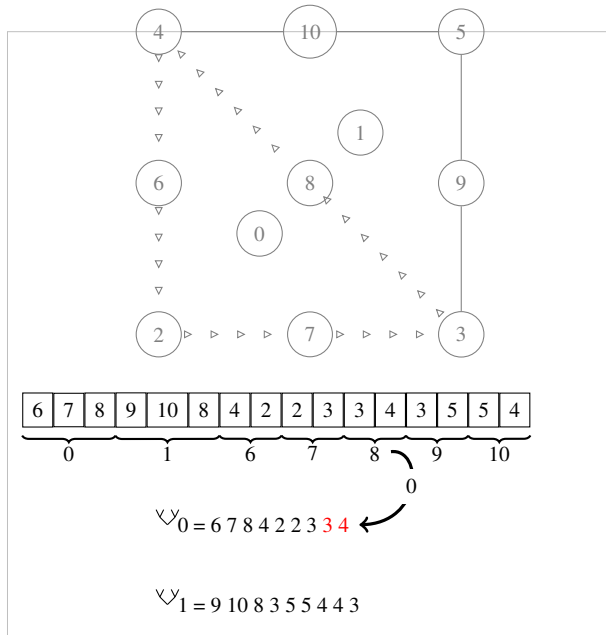


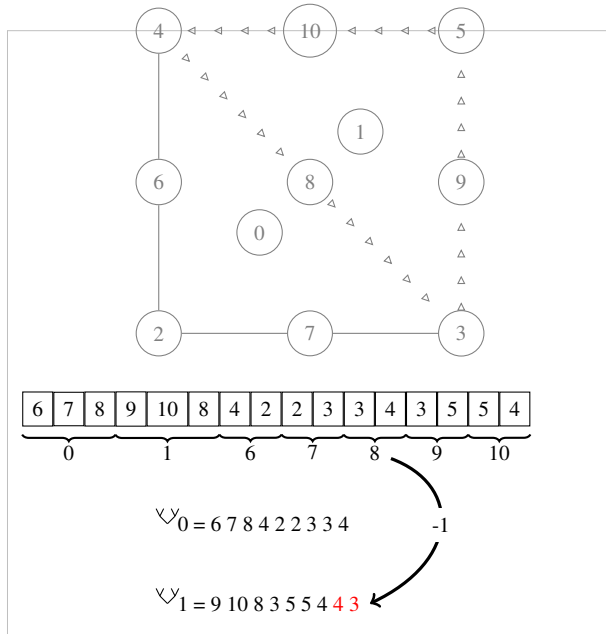


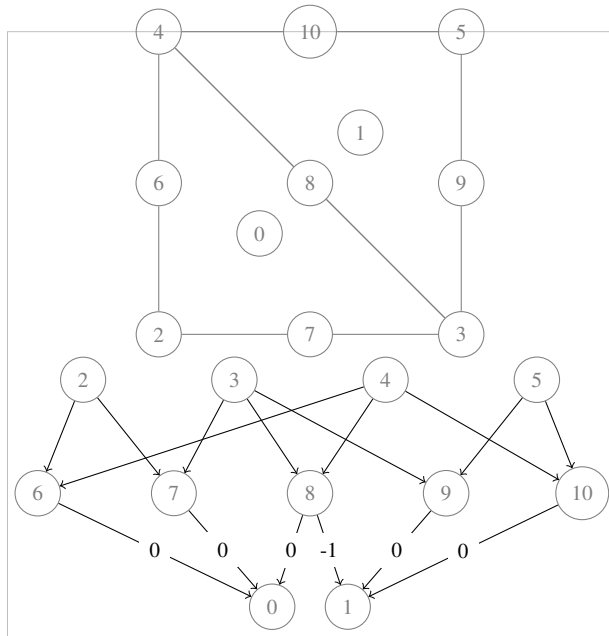


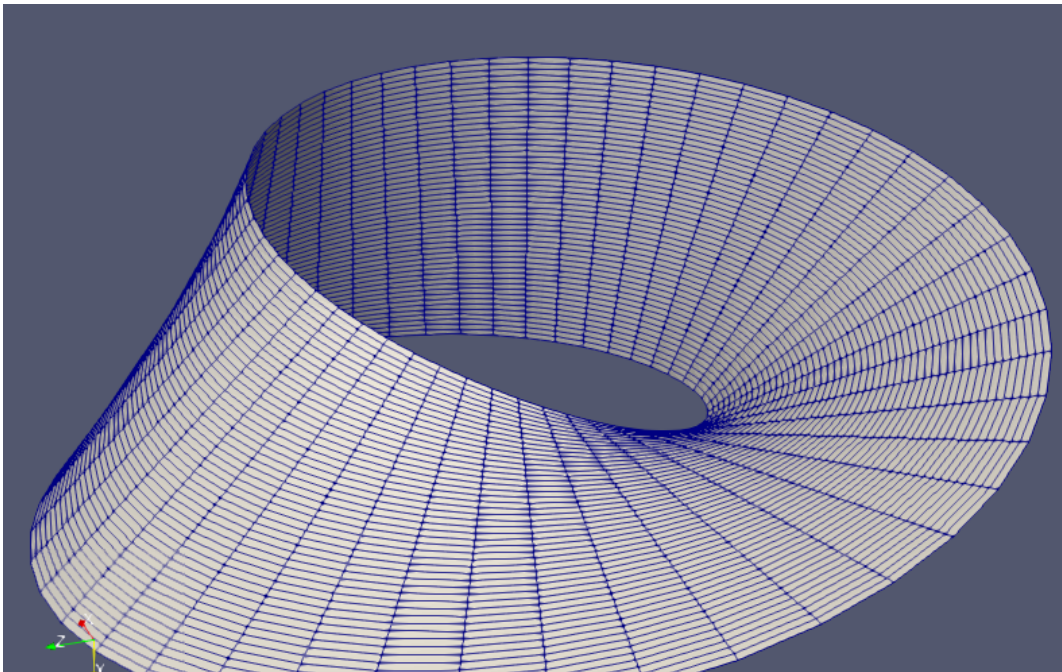


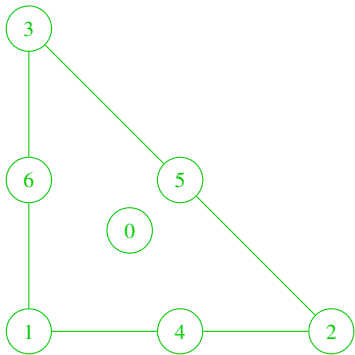


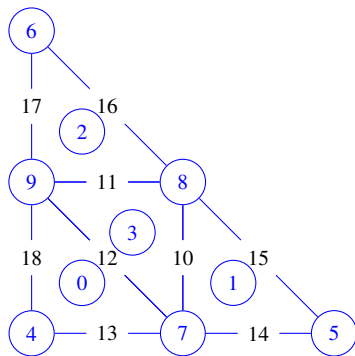
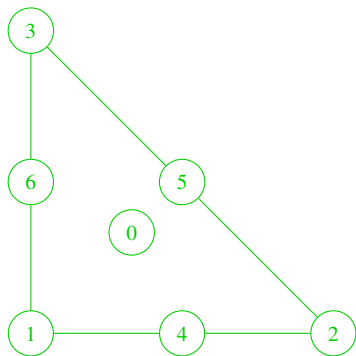












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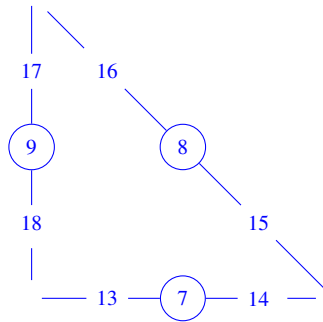
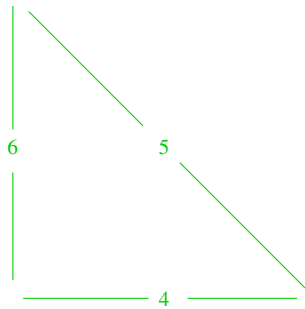
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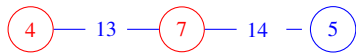
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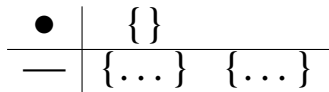














— | $\{(\mathbf{1}, \dots), \dots\} \quad \{\dots\}$



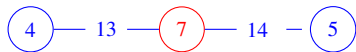
— | $\{(1, \mathbf{0}, \dots), \dots\} \quad \{\dots\}$



— | $\{(1, 0, \mathbf{0}), \dots\} \quad \{\dots\}$



— | $\{(1, 0, 0), (\mathbf{0}, \dots)\} \quad \{\dots\}$



— | $\{(1, 0, 0), (0, \mathbf{0})\} \quad \{\dots\}$



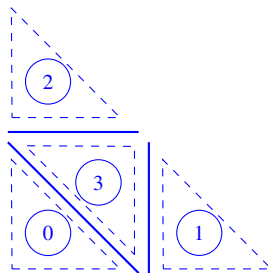
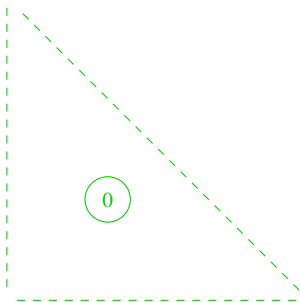
— | $\{(1, 0, 0), (0, 0)\}$ $\{(0, 0), (\textcolor{red}{1}, \dots)\}$

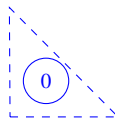
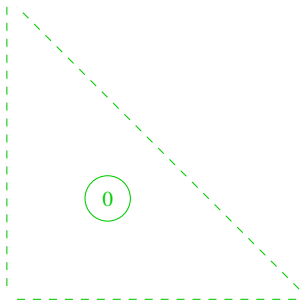


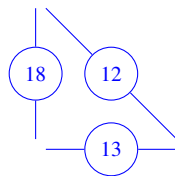
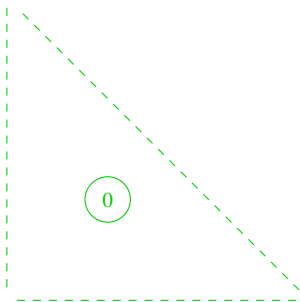
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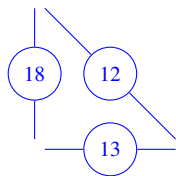
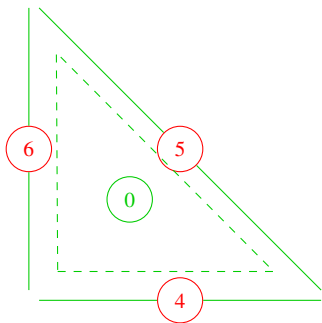
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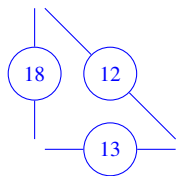
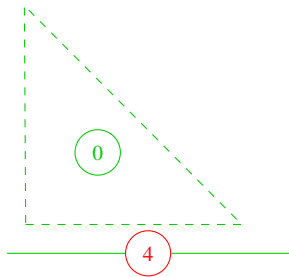




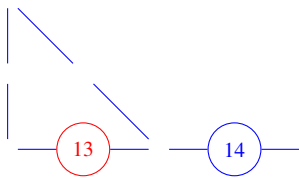
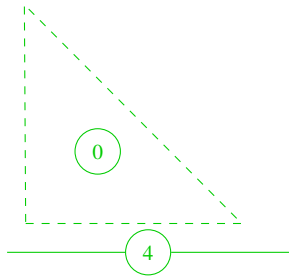

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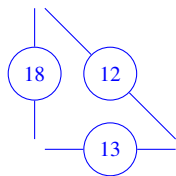
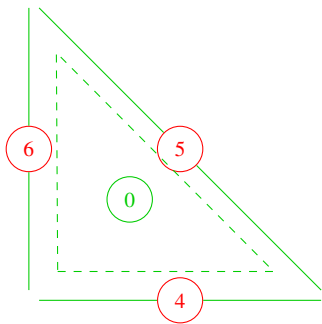
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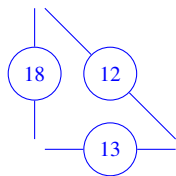
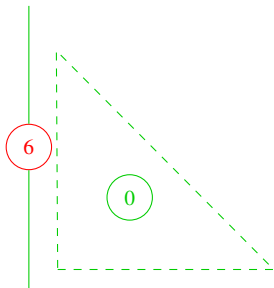

 $\left| \{1, \textcolor{red}{0}, \dots\} \quad \{\dots\} \quad \{\dots\} \right.$



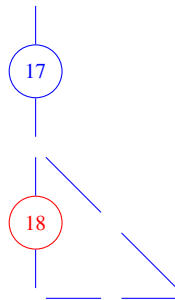
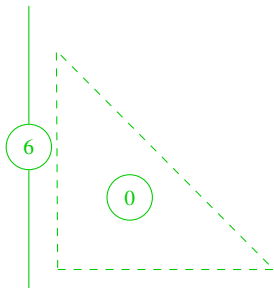
$\triangleleft \mid \{1, 0, \mathbf{0}\} \quad \{\dots\} \quad \{\dots\}$



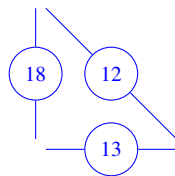
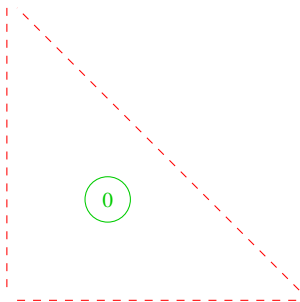
$\triangleleft \mid \{1, 0, 0\} \quad \{\dots\} \quad \{\mathbf{1}, \dots\}$



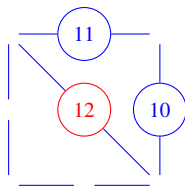
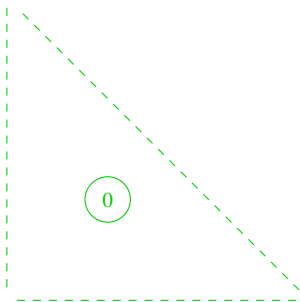
$\triangleleft \mid \{1, 0, 0\} \quad \{\dots\} \quad \{1, \textcolor{red}{2}, \dots\}$



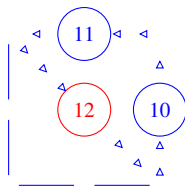
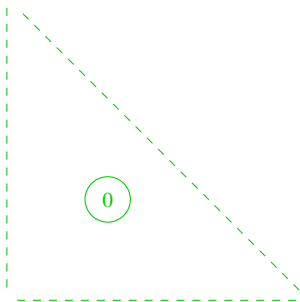
$\triangleleft \mid \{1, 0, \textcolor{red}{0}\} \quad \{\dots\} \quad \{1, 2, \textcolor{red}{1}\}$



$\triangleleft$ | $\{1, 0, 0\}$ $\{\textcolor{red}{0}, \dots\}$ $\{1, 2, 1\}$



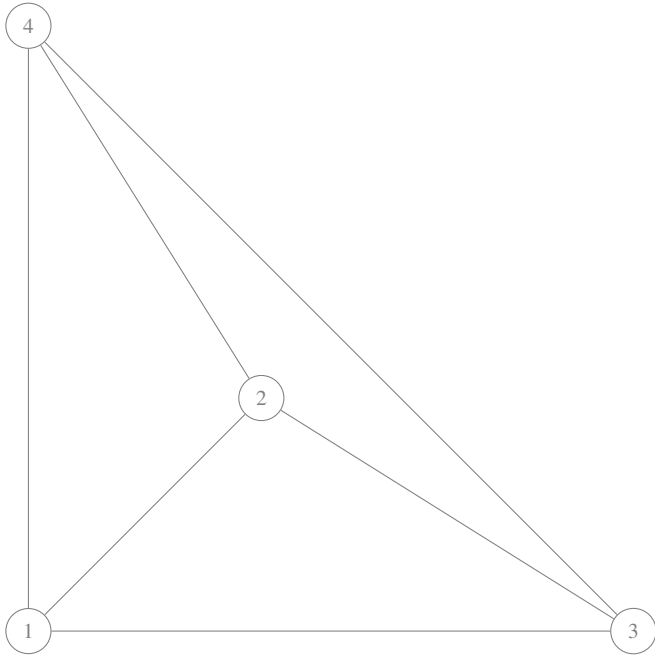
$\triangleleft$ | $\{1, 0, 0\}$ $\{0, \textcolor{red}{2}, \dots\}$ $\{1, 2, 1\}$

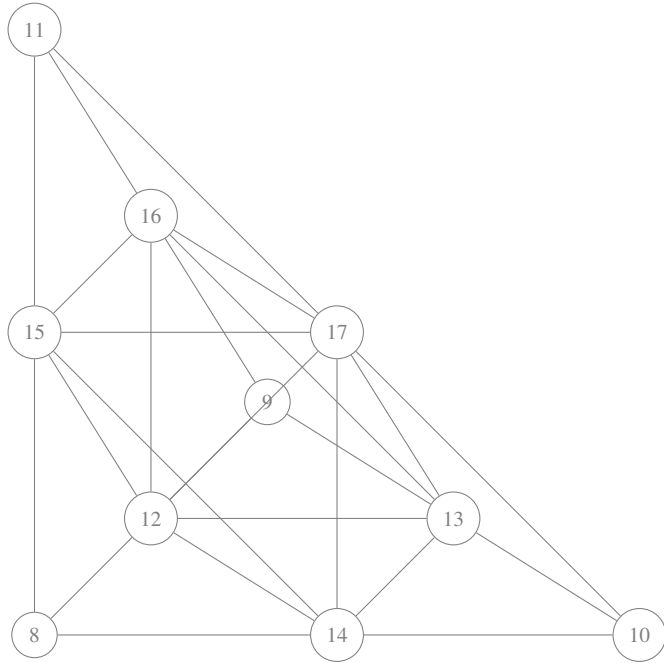


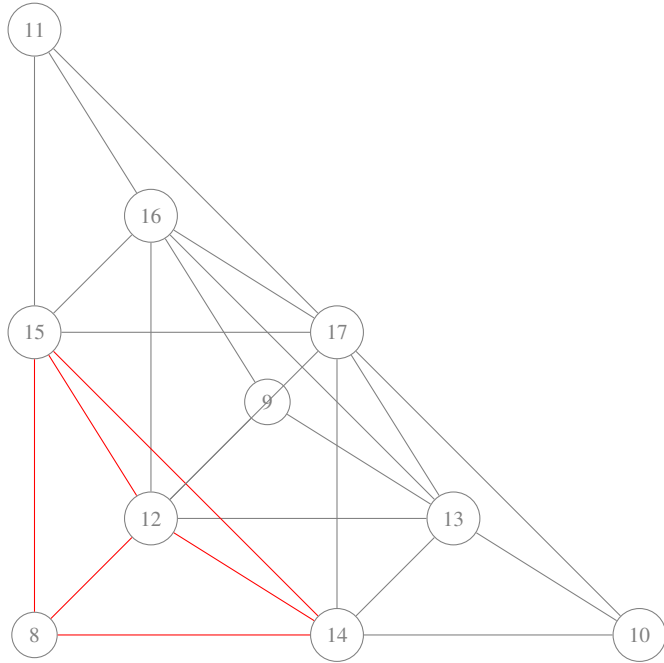
$\triangleleft$ | $\{1, 0, 0\}$ $\{0, 2 \text{ (-1)}\}$ $\{1, 2, 1\}$

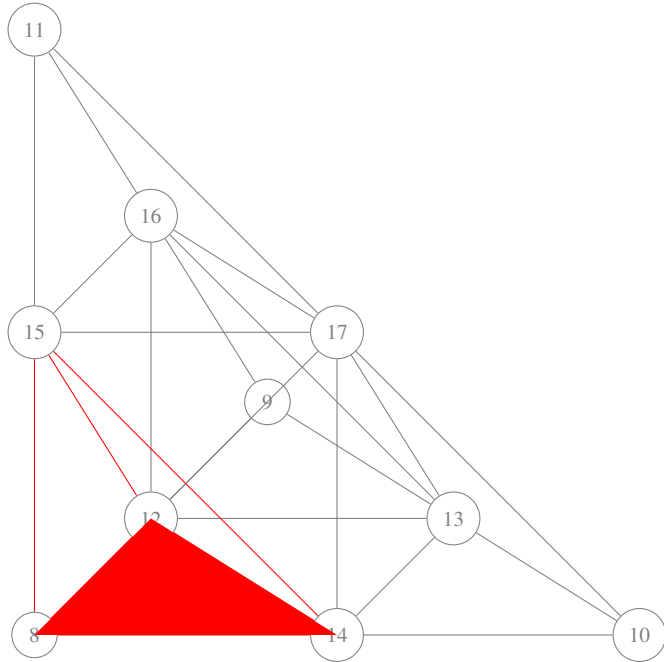
$\bullet$	$\{\}$
—	$\bullet \quad (1, 0, 0) \quad \bullet \quad (0, 0)$
—	$\bullet \quad (0, 0) \quad \bullet \quad (1, 1, 0)$

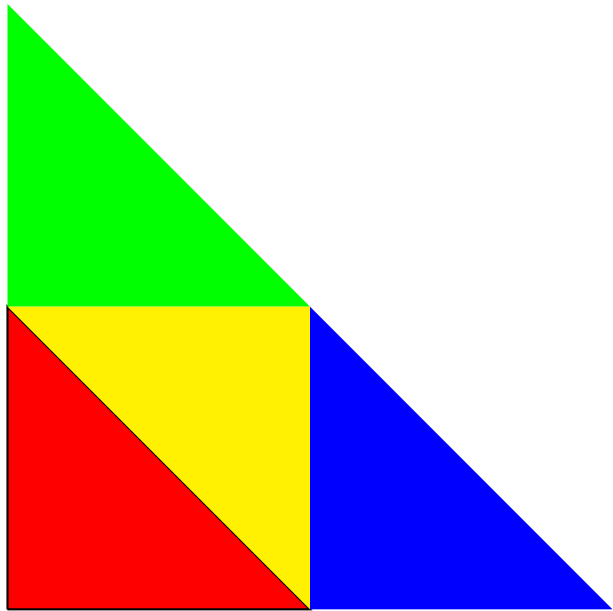
—	$\bullet \quad (1, 0, 0) \quad \bullet \quad (1, 1, 0)$
—	$\bullet \quad (1, 1, 0) \quad \bullet \quad (1, 2, 0)$
—	$\bullet \quad (1, 2, 0) \quad \bullet \quad (1, 0, 0)$
$\triangleleft$	— $(1, 0, 0)$ — $(0, 2 \ (-1))$ — $(1, 2, 1)$
$\triangleleft$	— $(1, 0, 1)$ — $(1, 1, 0)$ — $(0, 0 \ (-1))$
$\triangleleft$	— $(0, 1 \ (-1))$ — $(1, 1, 1)$ — $(1, 2, 0)$
$\triangleleft$	— $(0, 0)$ — $(0, 1)$ — $(0, 2)$

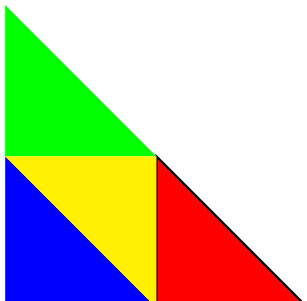
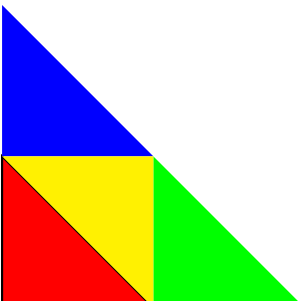
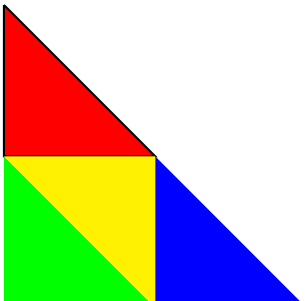
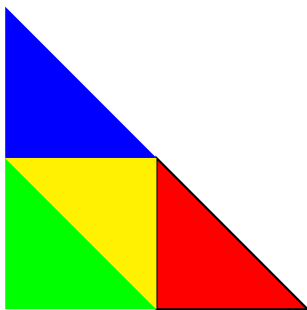
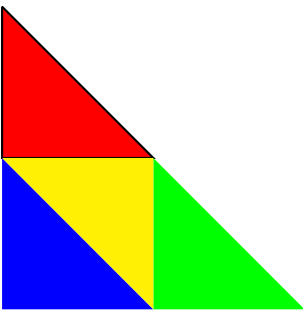
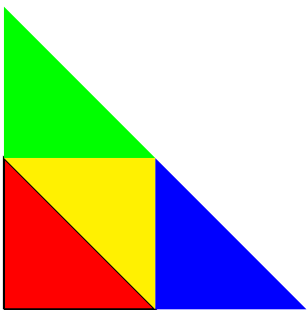


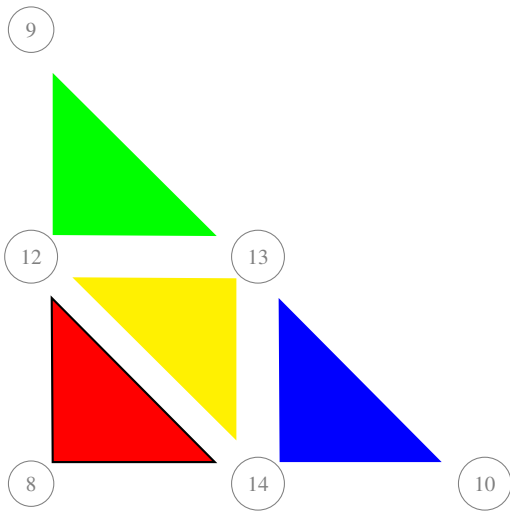




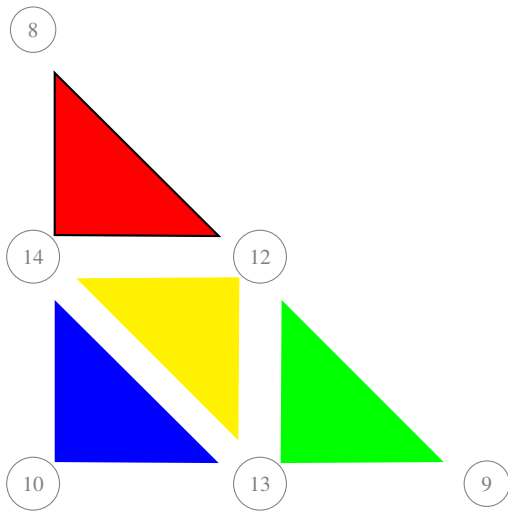




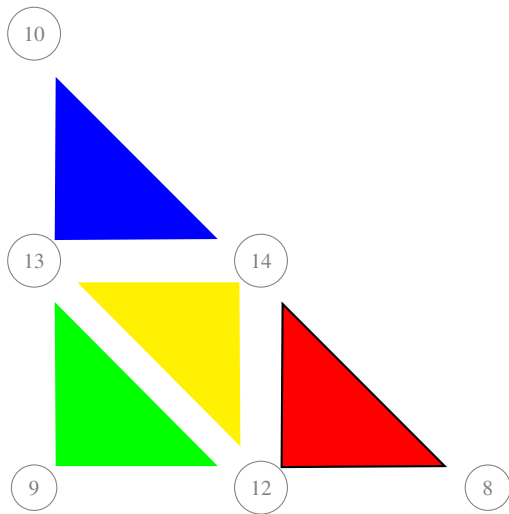




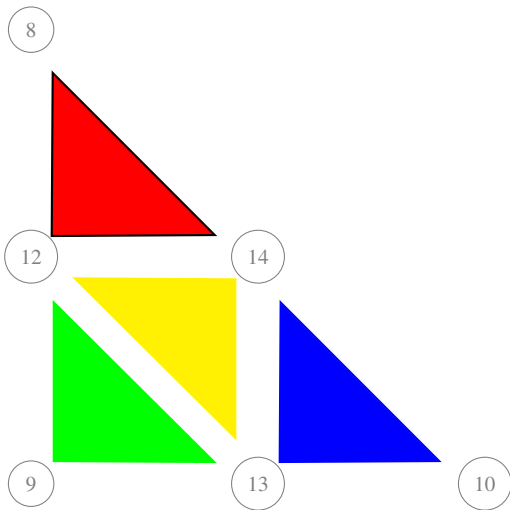
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{red}{0}, 0)$$



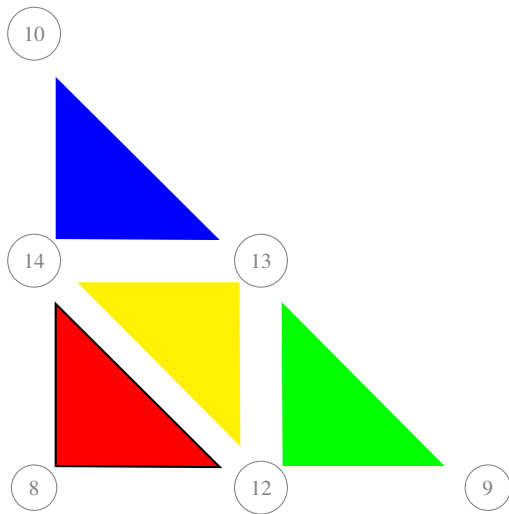
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{blue}{1}, 1)$$



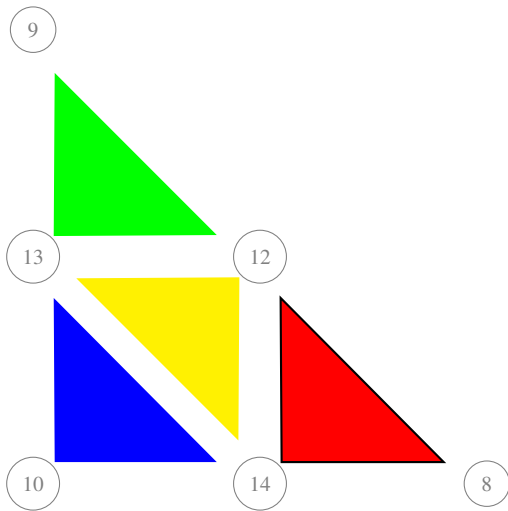
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{green}{2}, 2)$$



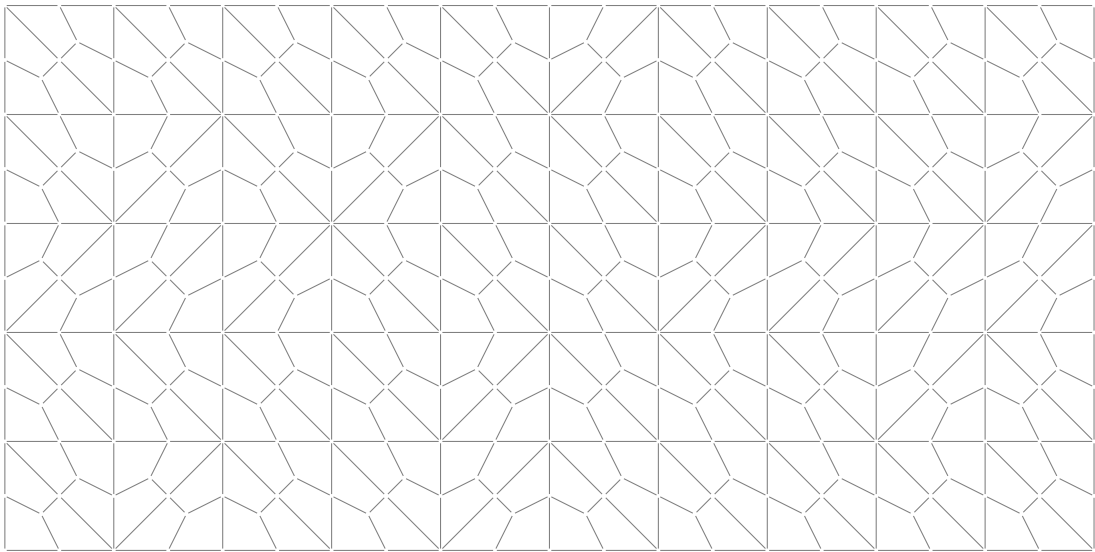
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{green}{2}, -1)$$

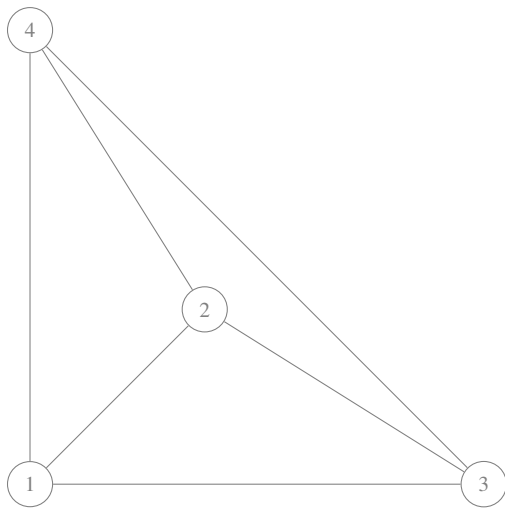


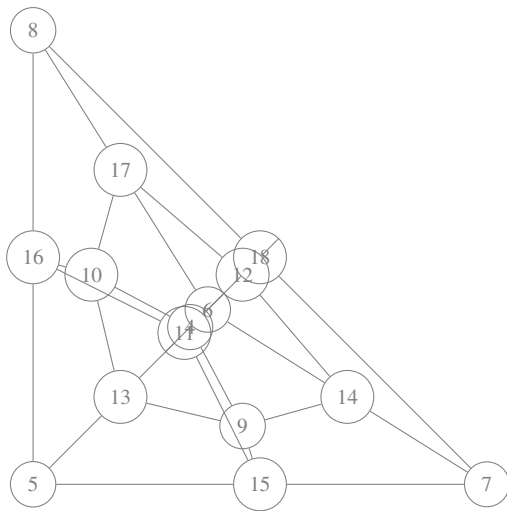
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{red}{0}, -2)$$

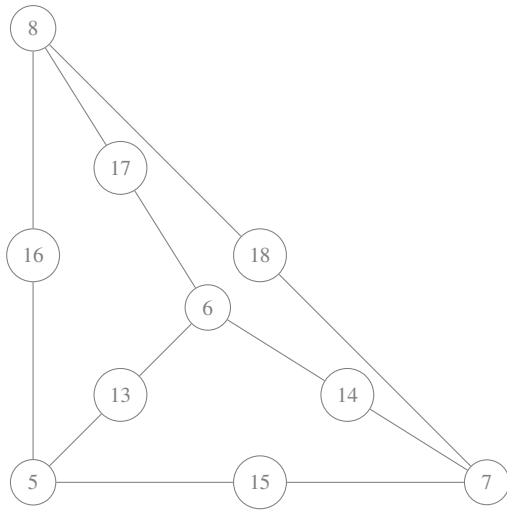


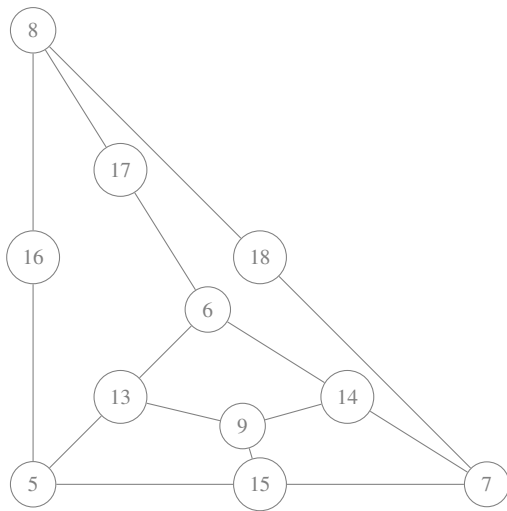
$$(\textcolor{red}{0}, 0) \longrightarrow (\textcolor{blue}{1}, -3)$$

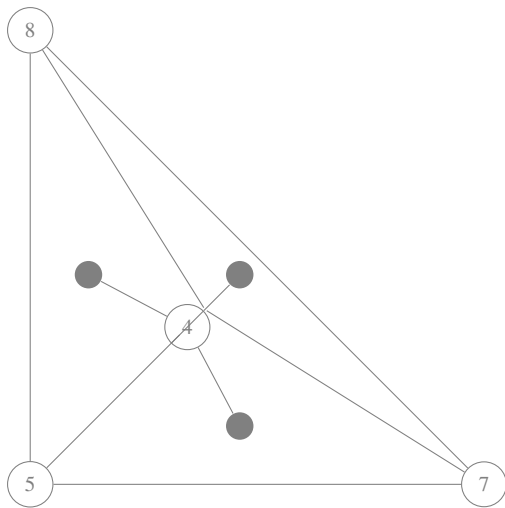


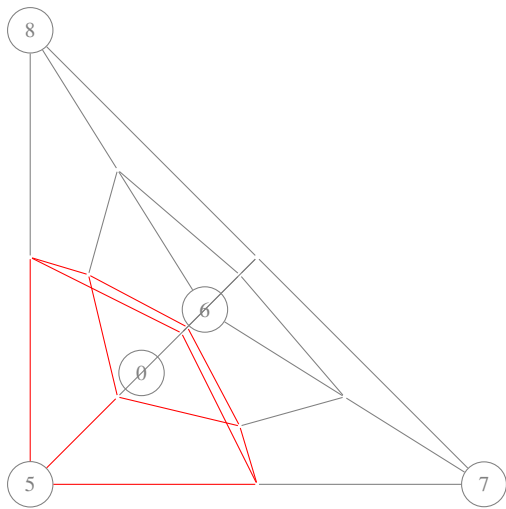


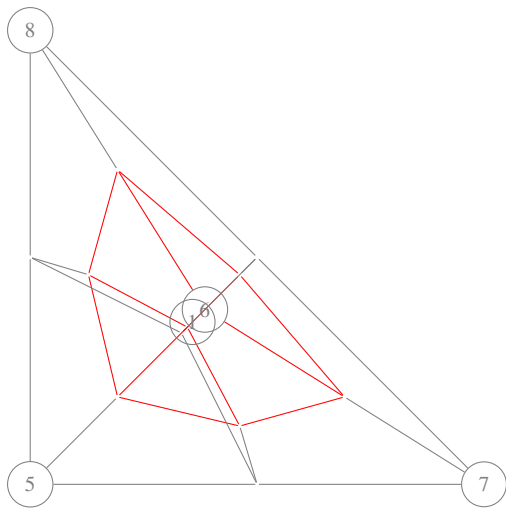


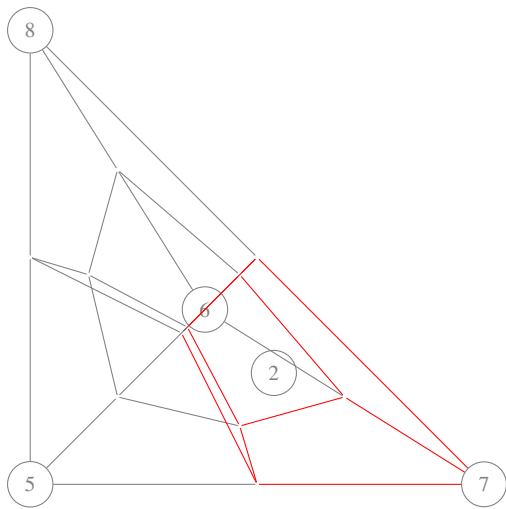


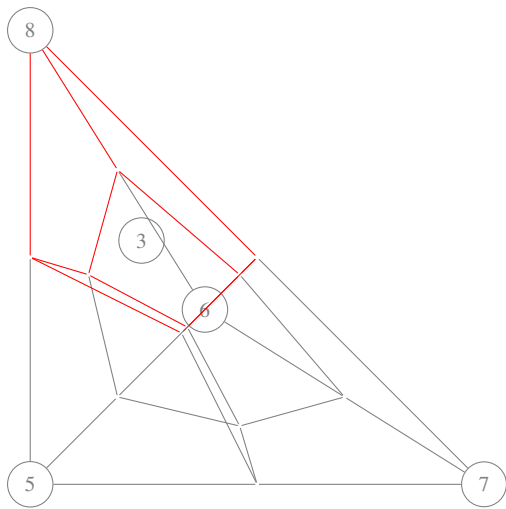


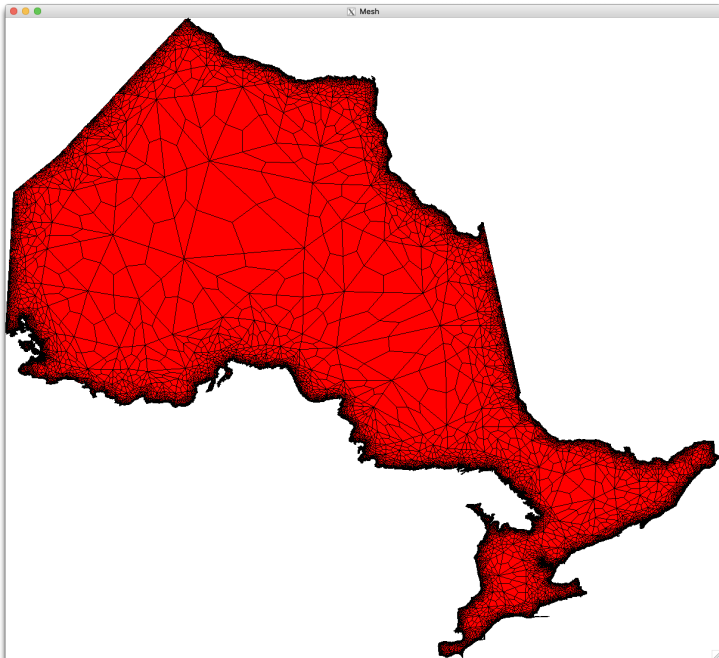


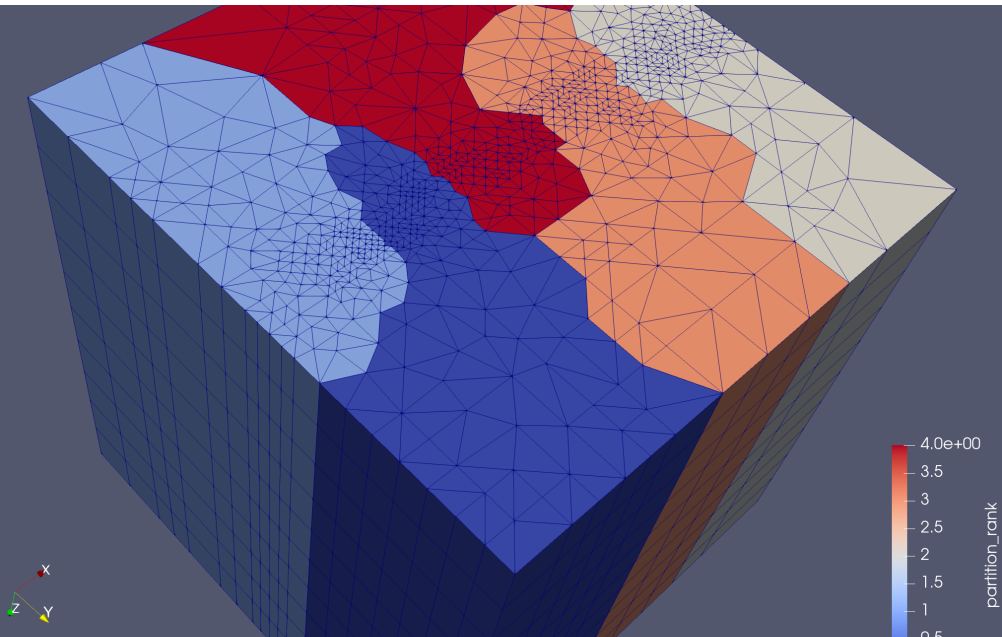


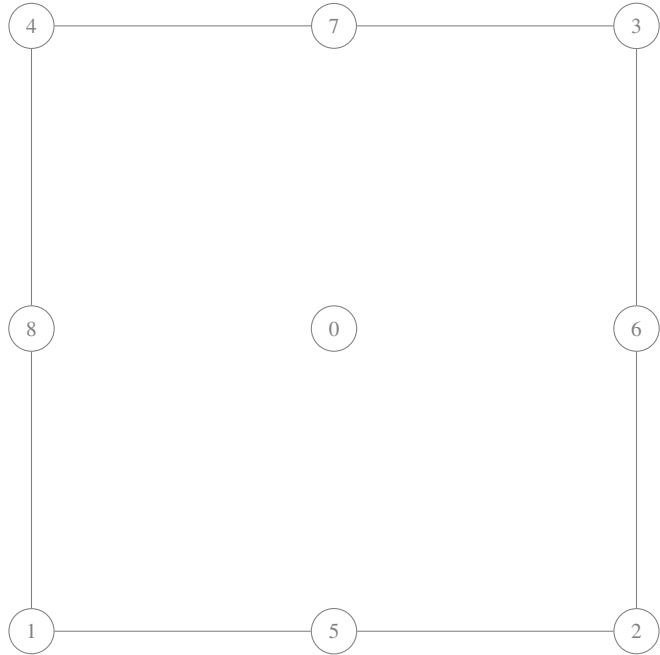


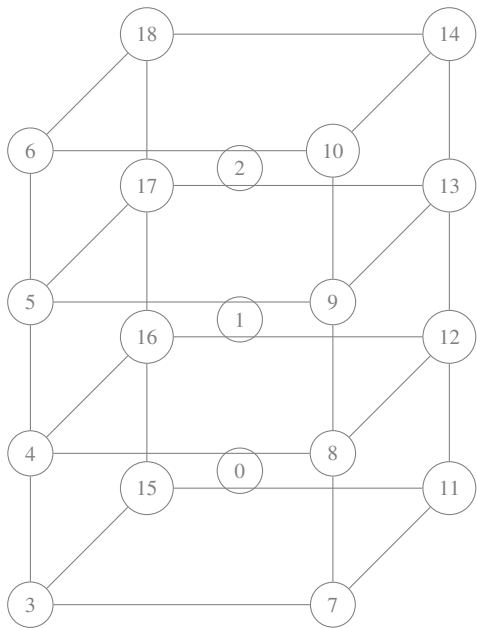
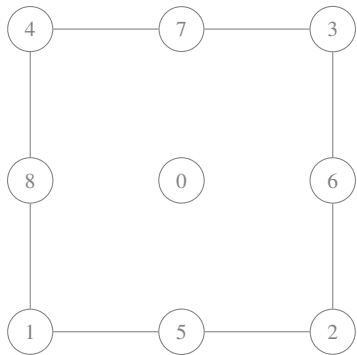


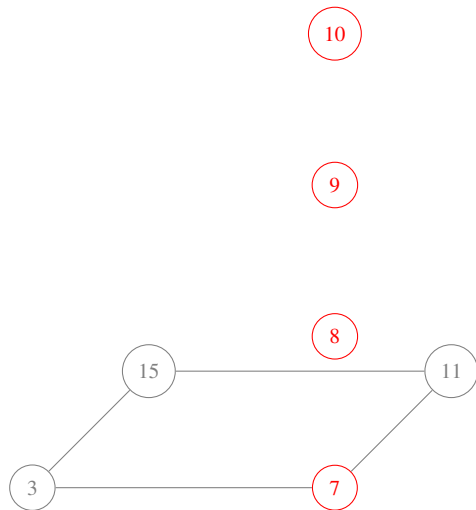
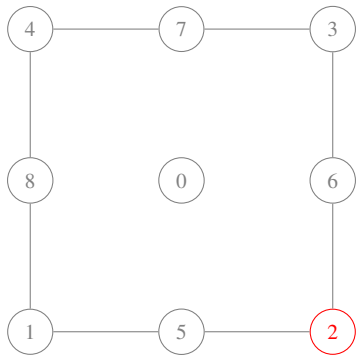


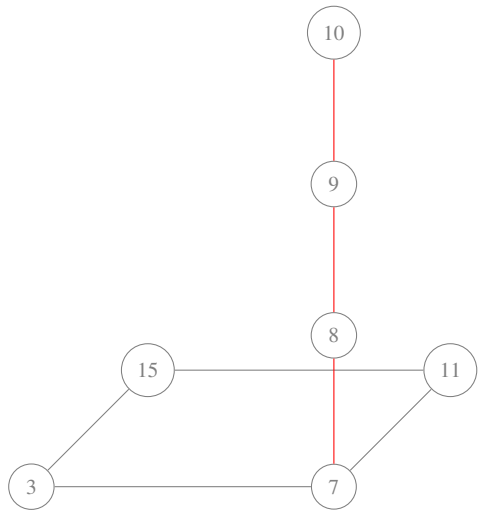
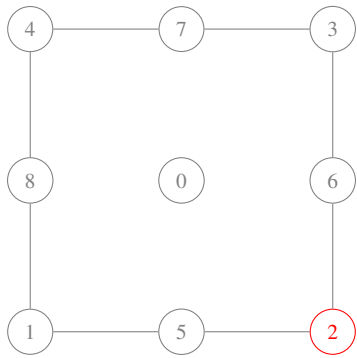


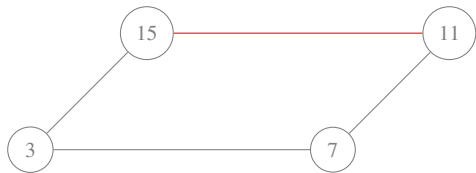
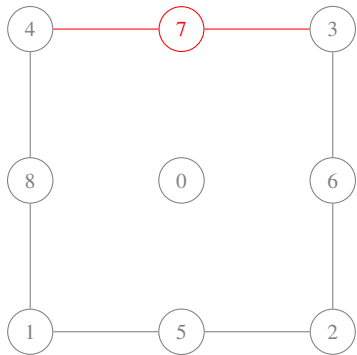


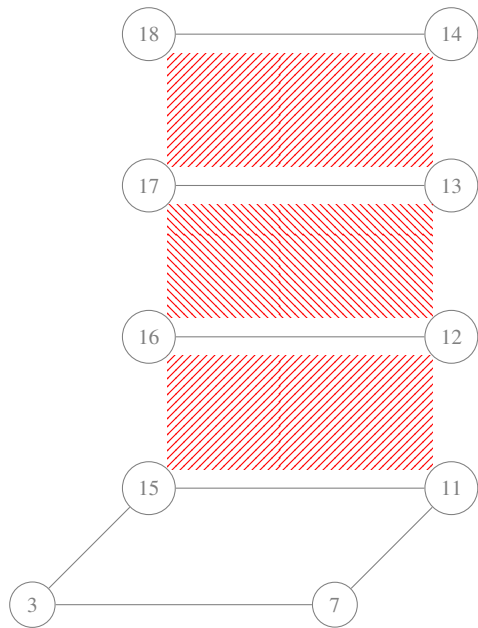
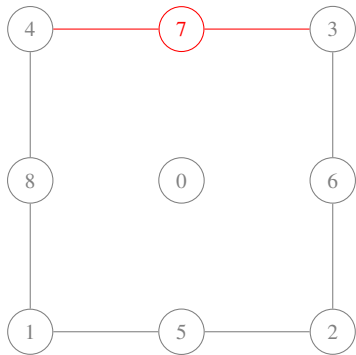


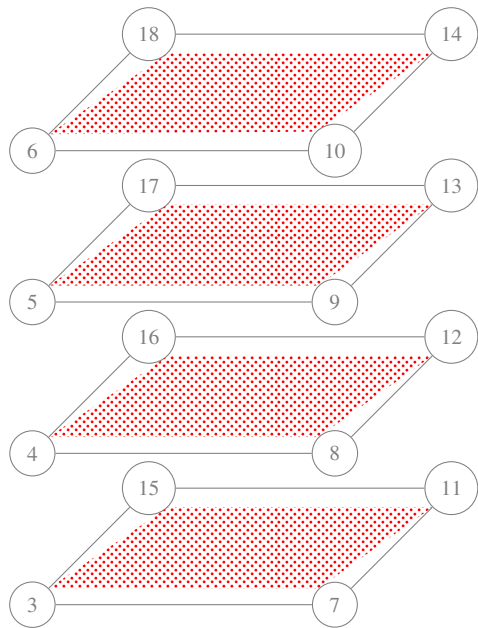
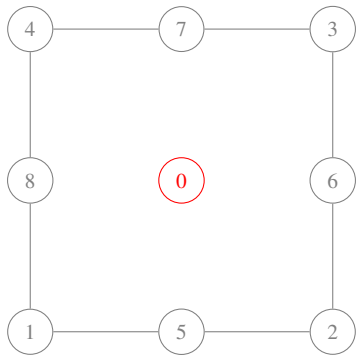


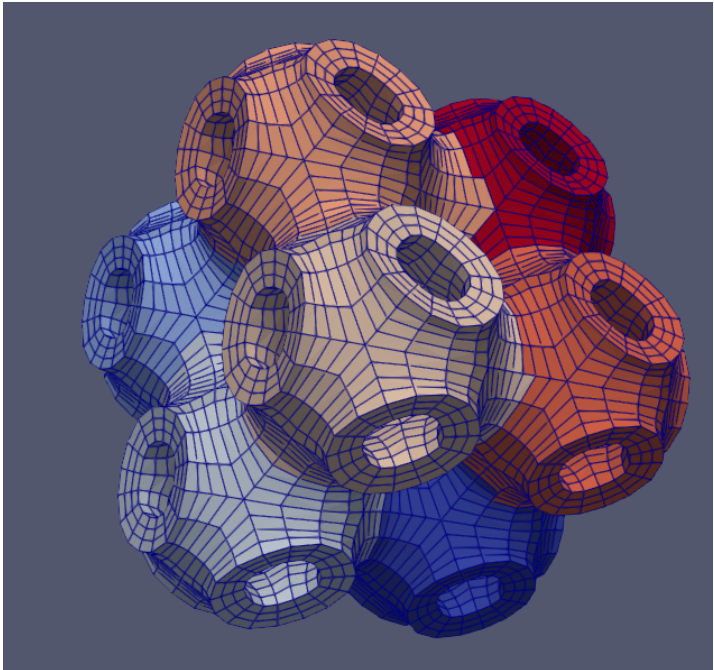


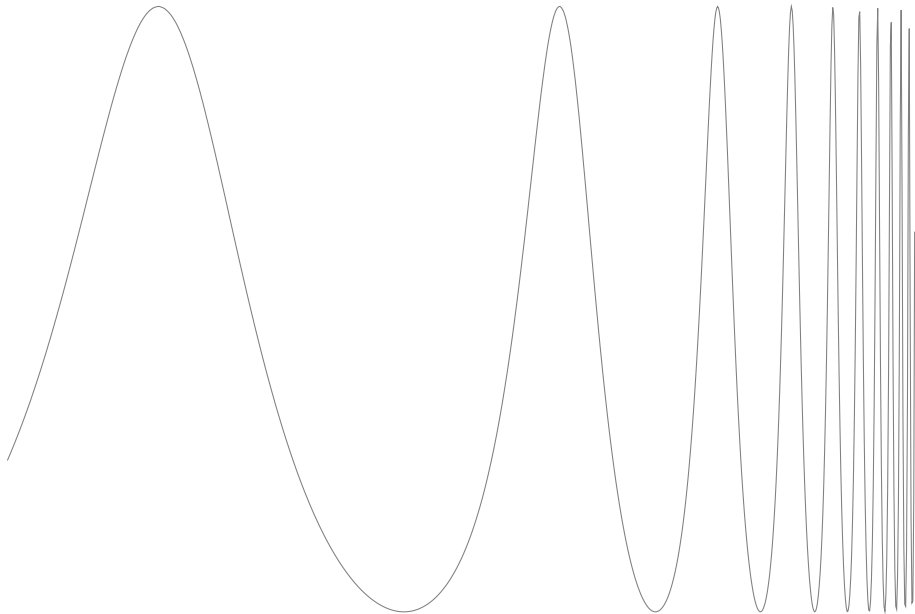


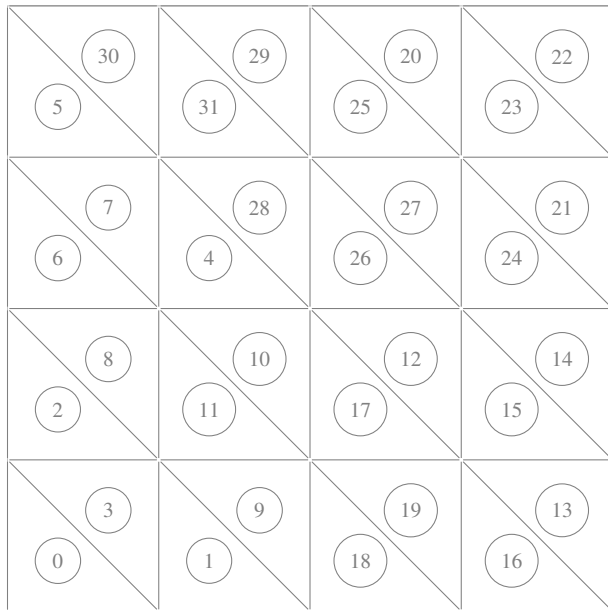


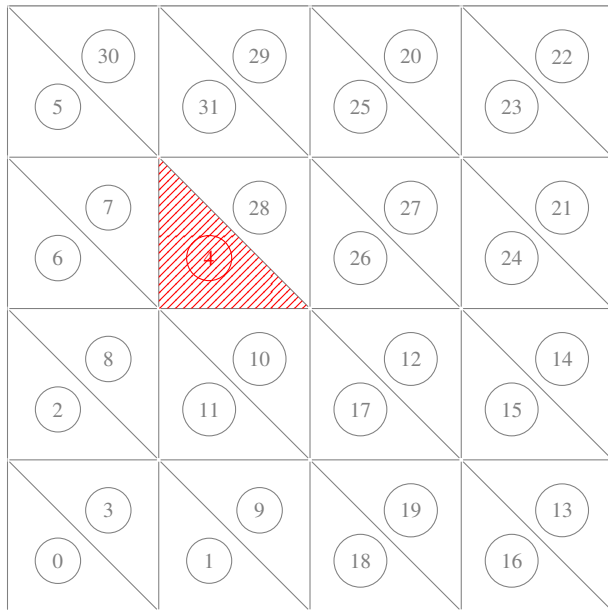


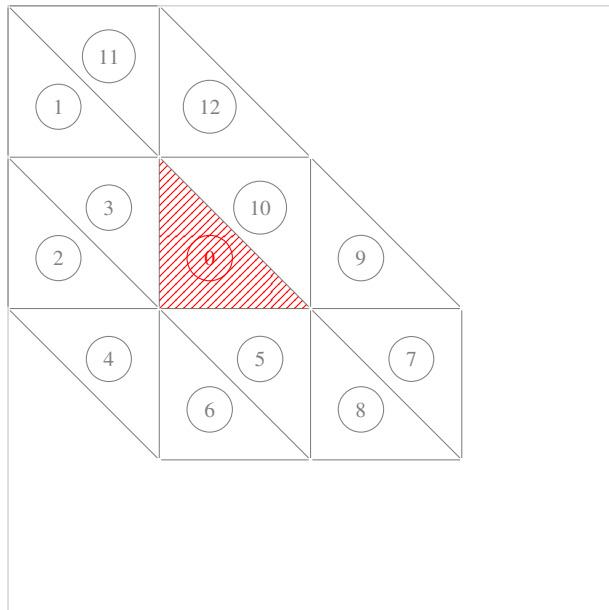


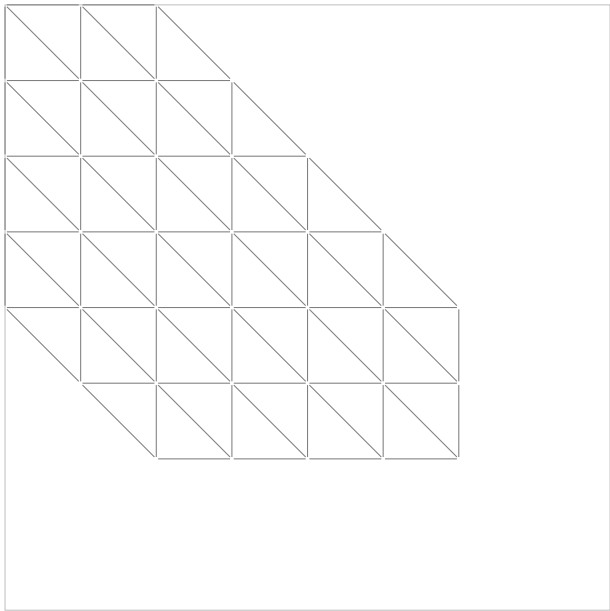


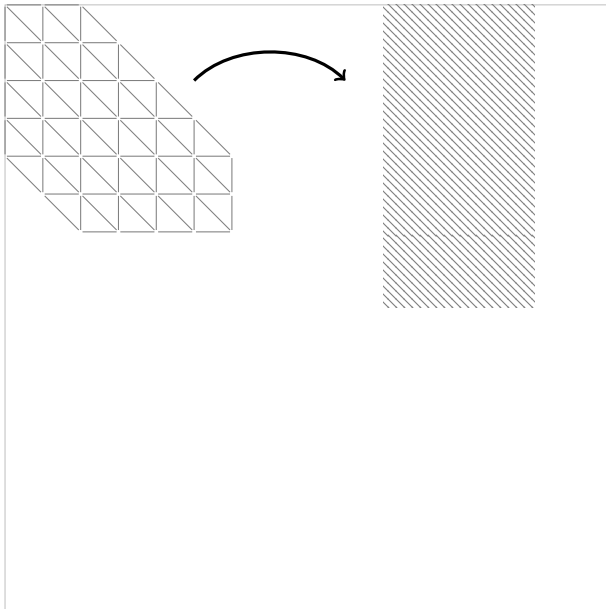


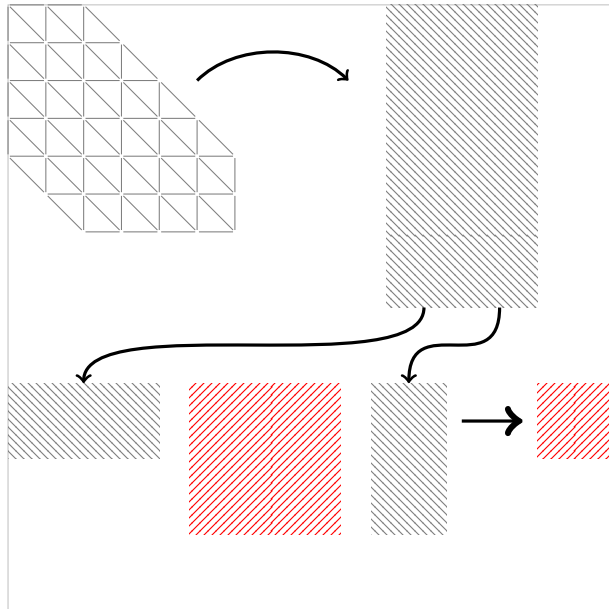


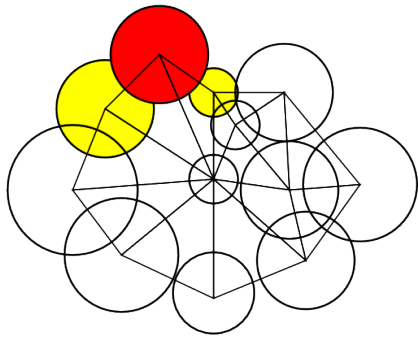
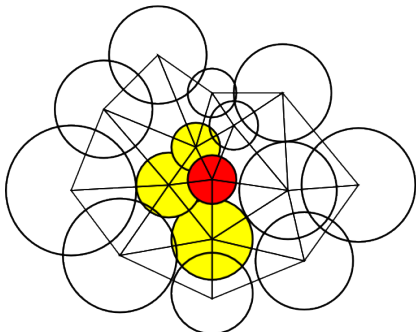
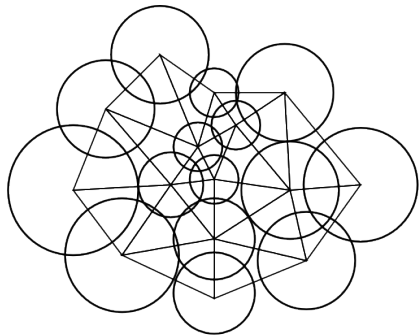
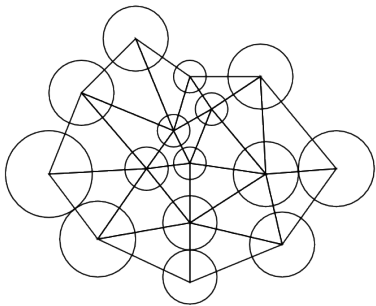


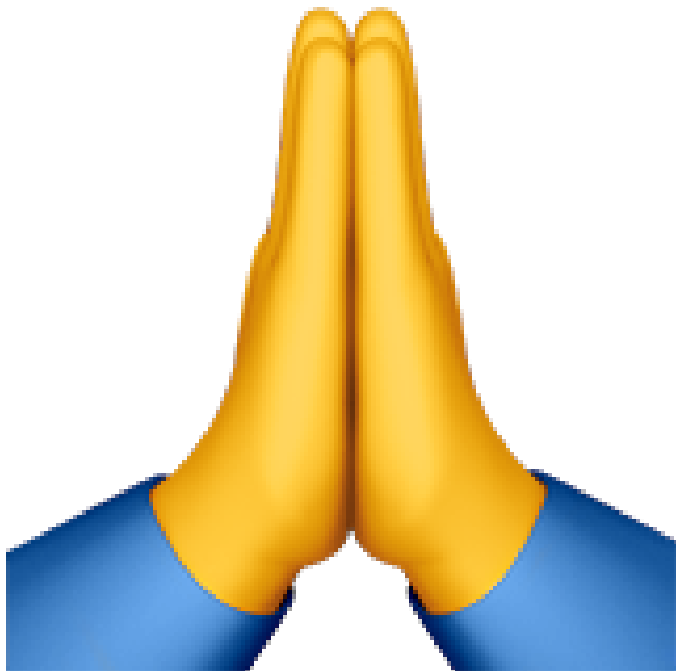












References I