A truck traveling from New York to Baltimore is to be loaded with two types of cargo. Each crate of cargo A is 5 cubic feet in volume, weighs 100 pounds, and earns $12 for the driver. Each crate of cargo B is 3 cubic feet in volume, weighs 25 pounds, and earns $7 for the driver. The truck can carry no more than 300 cubic feet of crates and no more than 1,000 pounds (half-ton pickup truck). Also, the number of crates of cargo B must be less than or equal to twice the number of crates of cargo A.
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Setup the linear programming problem to maximize the drivers earnings.
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Setup the linear programming problem to maximize the drivers earnings.

- Find all linear constraints and the objective function.
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Setup the linear programming problem to maximize the drivers earnings.

- Find all linear constraints and the objective function.
- Use the corner-point method to solve.
A truck traveling from New York to Baltimore is to be loaded with two types of cargo.

- **crate A**
  - each crate of cargo A is 5 cubic feet in volume
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- **another restriction**
  - number of creates of cargo B must be less than or equal to twice the number of crates of cargo A
let $x$ be number of crates of A

Problem:
maximize $z = 12x + 7y$
subject to constraints.
let $x$ be number of crates of A
let $y$ be the number of crates of B
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**Problem:** maximize drivers earnings subject to constraints
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**Problem:** maximize drivers earnings subject to constraints

- maximize \( z = 12x + 7y \)
- subject to constraints.
**Constraint:** The truck can carry no more than 300 cubic feet of crates.

\[(\text{cubic feet of A}) + (\text{cubic feet of B}) \leq 300 \text{ft}^3\]
**Constraint:** The truck can carry no more than 300 cubic feet of crates.

- \((\text{cubic feet of A}) + (\text{cubic feet of B}) \leq 300\text{ft}^3\)
- \(\left(\frac{5\text{ft}^3}{1\text{crate}} \times \text{num crates A}\right) + \left(\frac{3\text{ft}^3}{1\text{crate}} \times \text{num crates B}\right) \leq 300\text{ft}^3\)
**Constraint:** The truck can carry no more than 300 cubic feet of crates.

- \((\text{cubic feet of } A) + (\text{cubic feet of } B) \leq 300\text{ft}^3\)
- \((\frac{5\text{ft}^3}{1\text{crate}} \cdot \text{num crates } A) + (\frac{3\text{ft}^3}{1\text{crate}} \cdot \text{num crates } B) \leq 300\text{ft}^3\)
- \(5 \cdot x + 3 \cdot y \leq 300\)
**Constraint:** The truck can carry no more than 1,000 pounds.

\(( \text{weight of A}) + (\text{weight of B}) \leq 1,000 \text{lbs}\)
Constraint: The truck can carry no more than 1,000 pounds.

- \((\text{weight of } A) + (\text{weight of } B) \leq 1,000\text{lbs}\)
- \((\frac{100\text{lbs}}{1\text{crate}} \cdot \text{num crates } A) + (\frac{25\text{lbs}}{1\text{crate}} \cdot \text{num crates } B) \leq 1,000\text{lbs}\)
**Constraint:** The truck can carry no more than 1,000 pounds.

- \((\text{weight of A}) + (\text{weight of B}) \leq 1,000\text{lbs}\)
- \((\frac{100\text{lbs}}{1\text{crate}} \cdot \text{num crates A}) + (\frac{25\text{lbs}}{1\text{crate}} \cdot \text{num crates B}) \leq 1,000\text{lbs}\)
- \(100 \cdot x + 25 \cdot y \leq 1,000\)
**Constraint:** number of crates of cargo B must be less than or equal to twice the number of crates of cargo A.

- $y \leq 2 \cdot x$
Constraint: number of crates of cargo B must be less than or equal to twice the number of crates of cargo A.

\[ y \leq 2 \cdot x \]

\[ -2x + y \leq 0 \]
Solve the following linear programming problem by the corner-point method.

Maximize: \( z = 12x + 7y \)  
subject to: \( 5x + 3y \leq 300 \)  
\( 100x + 25y \leq 1,000 \)  
\( -2x + y \leq 0 \)  
\( x \geq 0 \)  
\( y \geq 0 \)
Linear Programming
graph of constraints
Solve the following linear programming problem by the corner-point method.

Maximize: $z = 20x + 15y$ \hspace{1cm} (7)

subject to: $3x + 4y \leq 60$ \hspace{1cm} (8)
$4x + 3y \leq 60$ \hspace{1cm} (9)
$x \leq 10$ \hspace{1cm} (10)
$y \leq 12$ \hspace{1cm} (11)
$x \geq 0$ \hspace{1cm} (12)
$y \geq 0$ \hspace{1cm} (13)
Linear Programming
graph of constraints
### Corner Points

<table>
<thead>
<tr>
<th>Corner Point</th>
<th>$(x, y)$</th>
<th>$z = 20x + 15y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$(0, 0)$</td>
<td>$20(0) + 15(0) = 0$</td>
</tr>
<tr>
<td>B</td>
<td>$(0, 12)$</td>
<td>$20(0) + 15(12) = 180$</td>
</tr>
<tr>
<td>C</td>
<td>$(4, 12)$</td>
<td>$20(4) + 15(12) = 260$</td>
</tr>
<tr>
<td>D</td>
<td>$(\frac{60}{7}, \frac{60}{7})$</td>
<td>$20\left(\frac{60}{7}\right) + 15\left(\frac{60}{7}\right) = 300^*$</td>
</tr>
<tr>
<td>E</td>
<td>$(10, \frac{20}{3})$</td>
<td>$20(10) + 15\left(\frac{20}{3}\right) = 300^*$</td>
</tr>
<tr>
<td>F</td>
<td>$(10, 0)$</td>
<td>$20(10) + 15(0) = 200$</td>
</tr>
</tbody>
</table>

Note the tie for the highest value of $z$ between points D and E. All points on the line segment between D and E will give the same value for $z$ as at D and E. There are an infinite number of optimal solutions on $\overline{AD}$. 