HW 13
Solution

1. A) \[ f_a = \frac{(24 \times 8 \times 4)}{24 \times 109} = 3488 \]
   \[ f_b = \frac{(14 \times 8 \times 5)}{12 \times 136} = 6346.7 \]
   \[ f_c = \frac{(12 \times 12 \times 3)}{9 \times 65} = 3120 \]

<table>
<thead>
<tr>
<th></th>
<th>( P_i / \sqrt{f_i} )</th>
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<tbody>
<tr>
<td>A</td>
<td>1.47</td>
</tr>
<tr>
<td>B</td>
<td>1.53</td>
</tr>
<tr>
<td>C</td>
<td>1.07</td>
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B) \[ v_a = \frac{\sqrt{3488}}{\sqrt{3488} + \sqrt{6346.7}} = 0.43 \]
   \[ v_b = \frac{\sqrt{6346.7}}{\sqrt{3488} + \sqrt{6346.7}} = 0.57 \]

C) Net benefit = S.P_i - Cr.f_i / v_i = 0

\[ v_i = \frac{Cr.f_i}{(S.P_i)} \]
(2) A) 1st & 3rd claims are both true. The total restocks to each SKU i will increase from \( n \cdot f_i \) to \( 2n \cdot f_i \). & the total restocks will increase from \( 2n \sum_{i=1}^{n} f_i \) to
\[
\sum_{i=1}^{n} f_i
\]

B) 2nd & 3rd claims are true. SKU i will be restocked \( \sum_{i=1}^{n} f_i \) times. The 3rd claim holds by the same reasoning as in part a.
(3) 

a) \[ v_i = \frac{f_i}{\sqrt{2} f_j} \cdot V \]

b) \[ v_i = \frac{\sqrt{f_i}}{\sqrt{2} \sqrt{f_j}} \cdot V \]

\[ v_i = \cos \theta_i + \frac{\sqrt{f_i}}{\sqrt{2} \sqrt{f_j}} \cdot (v - \frac{2}{\sqrt{3}} s s_j) \]
④ a) Current dist.: 

\[ \begin{align*} 
A - B &= 1.84 \\
A - C &= 3 \\
A - D &= 2 \\
B - C &= 1.5 \\
B - D &= 2.5 \\
c - D &= 2 \\
\end{align*} \]

Current score: 60.68

An alternative:

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<th>C</th>
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<tbody>
<tr>
<td>A</td>
<td></td>
<td>C</td>
<td>B</td>
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<tr>
<td>D</td>
<td>D</td>
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<td>B</td>
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New centroids:

\[ \begin{align*} 
C_A^x &= 1 \\
C_B^x &= 3 \\
C_C^x &= 2 \\
C_D^x &= \frac{1+2+3}{2} = 2 \\
C_A^y &= 2.5 \\
C_B^y &= \frac{1+2+3}{3} = 2 \\
C_C^y &= \frac{2+3}{2} = 2.5 \\
C_D^y &= 1 \\
\end{align*} \]

New dist.: 

\[ \begin{align*} 
A - B &= 2 + 0.5 = 2.5 \\
A - C &= 1 + 0 = 1 \\
A - D &= 0.5 + 1.5 = 2 \\
B - C &= 1 + 0.5 = 1.5 \\
B - D &= 1.5 + 1 = 2.5 \\
c - D &= 0.5 + 1.5 = 2 \\
\end{align*} \]
\[ \text{New score} = 2 \times 2.5 + 12 \times 1 + 6 \times 2 + 0 \times 1.5 \]

\[ + 2 \times 2.5 + 2 \times 2 = 38 \Rightarrow \text{Since score decreased, it improved.} \]
5) a) Receiving, putaway, picking, check-pack-ship
    Picking is the most labor intensive

b) Order picking is the most labor intensive
    & determines the level of service experienced
    by the customer. Whereas, the efficiency of
    order-picking is determined to some extent by
    putaway.