1. The bill of materials for a finished product F1 is given below. The number in parentheses indicates the lead time (in weeks) for making or purchasing each item.

Item F1 (1): Composed of one unit of A1, A2 and A4, and 2 units of A3.
Item A2 (1): Composed of 1 unit of A4, B1 and 2 units of B2
Item A3 (3): Composed of B1 and B2 and 3 units of B3
Item A4 (4): Composed of 2 units of B3
Item B1 (1): Composed of 1 unit of B3 and 2 units of C1
Item B2 (5): Composed of 1 unit of C1 and C2
Item B3 (2): Composed of 1 unit of C1, C2 and C3
Items C1, C2 and C3 are purchased parts. Their lead times are 2, 1, and 4 weeks, respectively.

(a) (4 points) Draw the product structure.
(b) (4 points) What is the lead time for making item F1?
(c) (8 points) Forecasted demand for item F1 for the next 10 weeks is given as follows:

<table>
<thead>
<tr>
<th>Week</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>70</td>
<td>80</td>
<td>100</td>
<td>150</td>
<td>120</td>
<td>220</td>
<td>60</td>
</tr>
</tbody>
</table>

There will be 20 units in stock at the beginning of week 14, and the company expects 20, 60, 35 and 40 units to arrive in stock in weeks 15, 16, 17, and 18, respectively. Compute the time phased net requirements for item F1.

(d) (4 points) If the company expects 30 and 20 units of A4 to arrive in stock in weeks 13 and 15, compute the time phased net requirements for item A4.

2. (16 points) Consider the following net requirements for an item:

<table>
<thead>
<tr>
<th>Week</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>70</td>
<td>80</td>
<td>100</td>
<td>120</td>
<td>60</td>
<td>110</td>
<td>60</td>
</tr>
</tbody>
</table>

The setup cost is $200 and the holding cost is $0.5 per item per week. Compute alternative planned order releases for this item using the following lot sizing rules:

a. lot-for-lot
b. EOQ
c. Silver-Meal
d. Part period balancing.

Compute the total setup and holding cost of each alternative plan.
3. (4 points) (a) Discuss why the EOQ formula may give poor results for determining planned order releases in MRP calculation.
(b) Discuss the advantages of having small lot sizes.