The test is closed book. You may use one page of notes (using both sides). BE SURE TO WRITE YOUR NAME ON THE TEST.

1. (10 points) For each of the following schedules, determine whether it is conflict serializable (show the full precedence or conflict graph). You do not need to place locks.

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>r(Z)</td>
</tr>
<tr>
<td>2</td>
<td>r(X)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>r(Z)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>r(Y)</td>
<td></td>
<td>r(X)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td></td>
<td>r(Y)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>w(Z)</td>
</tr>
<tr>
<td>8</td>
<td>w(X)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>w(Y)</td>
<td></td>
</tr>
</tbody>
</table>
\begin{tabular}{|l|c|c|}
\hline
(b) & T1 & T2 & T3 \\
\hline
1 & r(X) &  & \\
2 & r(Y) &  & \\
3 & w(X) &  & \\
4 &  & r(Y) & w(Y) \\
5 &  &  & \\
6 & w(Y) &  & \\
7 &  & r(X) & \\
8 & w(X) &  & \\
9 &  &  & w(Z) \\
\hline
\end{tabular}
2. (15/20 points) Insert the following values into an initially empty B+ tree of order $d = 2$.

- 19, 40, 37, 25, 30, 15, 70, 42, 35, 5, 20, 60, 11, 17 (*451 students stop here*)
- (*551 students continue with the following*) 29, 63, 10, 31
3. (14/20 points) For each of the following relations and sets of functional dependencies, convert the relation into BCNF (if it is not already). Be sure to identify all candidate keys.

   (a) relation ABCDE
       fd’s AB → D, CD → E, E → A

   (b) relation ABCDEF
       fd’s E → AB, F → D, D → C
(c) \textbf{551}: relation $ABCDEF$

fd's $A \rightarrow C$, $B \rightarrow D$, $C \rightarrow F$, $E \rightarrow A$, $F \rightarrow E$