**Open-ended questions: Students can work on separate papers and attach their answers to the questions. Students also can directly type in answers.**

1. **[15 pts]** Consider a binary heap with non-leaf nodes having a -number of children instead of two children.
   1. **[7 pts]** How would you represent the parent and child for this heap in an array? Imagine that you have a node to access its parent, , and its child, .
   2. **[8 pts]** What is the height of a heap of n elements in terms of *n* and *d*? Justify your answer.
2. **[50 pts, 10 pts each]** Solve the following recurrences using either the substitution method or Master’s Theorem. Students must provide the guessing function and show proof when the substitution method is used. If the Master’s Theorem is used, the constant conditions must be tested and confirmed. Students use the equation editor in latex format to type the work.

   2. .