# C201 Midterm 2 Exam (50 points)

In this exam, you are going to design java classes for the following problem.

1. A company has many employees. Each employee is either a manager or a worker. Any and all employees are under the **direct supervision** of a manager, except the CEO, who is also an employee (manager). All the employees in this company forms a tree structure, where the root is CEO, leaves are workers and internal nodes are managers.
2. In the following diagram, blue nodes (leaves) are workers, red nodes (internal nodes) are managers, and a link (orange arrow) represents direct supervision between a manager and an employee (supervisee).
3. In the diagram above, **direct supervision** exists between a tree node and its children; **indirect supervision** exists between a tree node and its grand-children, grand-grand-children, and so on.
4. Write java code of three classes (Employee, Worker, and Manager). Please specify appropriate qualifiers (public, private), data types, and return types.
   1. The program has a base class Employee. (3 point)
      1. Employee has three attributes (ID, first name, last name). (3 point)
      2. Employee has a constructor. (2 point)
      3. Employee has a method getFullName(), which returns the full name (first name + space + last name) of the employee. (3 point)
      4. Employee has an **abstract** method printMonthlyPayment(), which will be implemented by derived classes. (3 point)
   2. The program has a derived class Worker, which inherits from base class Employee. (3 point)
      1. Worker has an attribute, weekly salary. (2 point)
      2. Worker has a constructor. (3 point)
      3. Worker implements the method printMonthlyPayment(), which displays its full name and the payment amount (4 multiplies its weekly salary). (1 point)
   3. The program has a derived class Manager, which inherits from base class Employee. (3 point)
      1. Manager has an attribute, yearly salary. (2 point)
      2. Manager has an attribute, supervisees (an ArrayList), which is used to store all the employees under its **direct supervision**. (5 point)
      3. Manager has a constructor. (1 point)
      4. Manager has a method addSupervisee(Employee e), which adds Employee e to its ArrayList. (4 point)
      5. Manager has a method removeSupervisee(Employee e), which removes Employee e from its ArrayList. (4 point)
      6. Manager implements the method printMonthlyPayment(). (2 point)
         1. This method first displays the manager’s full name and the payment amount (yearly salary divided by 12); (4 points)
         2. This method then displays the full names of all the employees **directly** **and indirectly** **under this manager’s supervision** and their monthly payment. (2 points)
5. If your classes Employee, Worker, and Manager are implemented correctly, execution of the testing program (Exam2.java) should display the results as specified in comments at the end of the file.