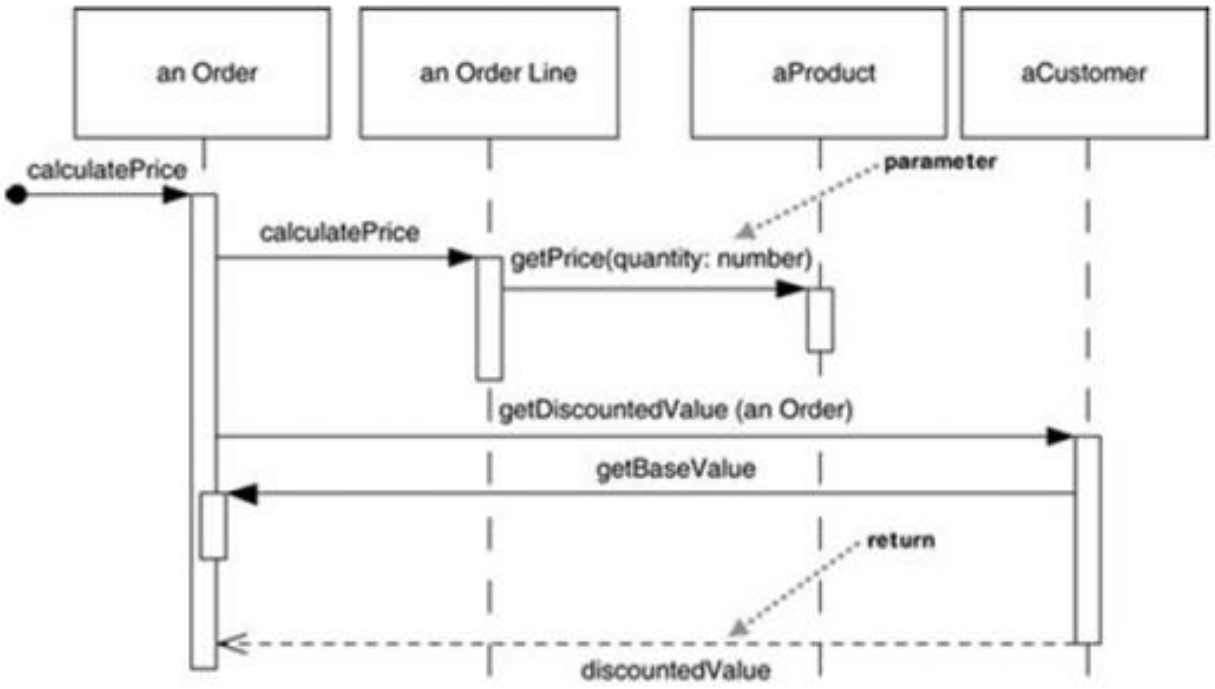
Lab 4

1. The following sequence diagram is incomplete. Re-draw the diagram so that it follows UML synatx rules.



In your diagram, do the following:

- Include message numbering
- Use proper UML syntax for the objects displayed at the top.
- Incidate looping wherever it occurs with Iteration markers

2. Create a sequence diagram based on the flow that occurs when an actor invokes the `checkoutBook()` method on `CheckoutForm`

```
//FROM CLASS CheckoutForm
   public void checkoutBook()  {

      theCheckoutController.checkoutBook(m_book, m_member);
      displayCheckoutInfo();
      clearCheckoutFields();
   }


//FROM CLASS CheckoutController
   public void checkoutBook(Book book, LibraryMember member) {

      CheckoutRecord aCheckoutRecord = new CheckoutRecord();
      aCheckoutRecord.setDueDate(member.getCheckoutPeriod());
      aCheckoutRecord.addBook( book );
      member.addCheckoutRecord( aCheckoutRecord );
      theILibraryDBSubsystem.addCheckoutRecord(member.getMemberID(),
                                       aCheckoutRecord);
   }
```

3. Create a sequence diagram for the next problem (Lab4 question 4, polymorphism).
   As described in the implementation details, this should be a distributed control solution. When you distribute control, make sure that the object that handles a step of processing really should be responsible for that behavior, based on the purpose of the class that was determined in the class diagram.

4. Polymorphism Question (implementation details on next page)

Objectives:

- Practice implementing and using polymorphic methods.
- Understand how the Template Method design pattern works.

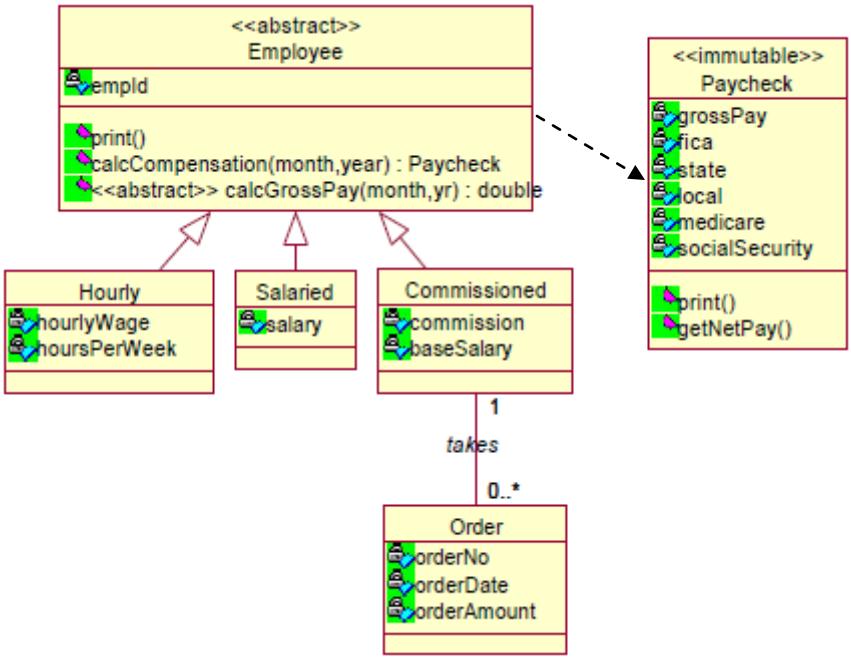
Human Resource Application:

The HR department has identified three types of Employees based on how they are paid: Hourly,
Salaried, and Commissioned. The paycheck for each type is calculated differently:

- Hourly employees are paid monthly and their paycheck amount is calculated based on their hourly wage and the hours per week they work. For simplicity just assume four weeks for each month.

- Salaried employees are paid monthly and their paycheck amount is a fixed amount every month.

- Commissioned employees are also paid monthly. They receive a small base salary, plus a percentage (commission) on the total value of all orders they sold during the previous month.



Tasks:

- Create a domain package and write code for all the classes in the diagram, including properties and methods

Impementation details for the concrete calcCompensation() method in Employee:

- This method takes the month and year as arguments for which to calculate the compensation.
    - For hourly and salaried employees the amount is the same every month.
    - For Commissioned employees the amount is their baseSalary plus their commission percentage times the orderAmount of their orders in that month. (For the sake of simplicity you can assume all the orders are in the given month)
- The `Employee.calcCompensation()` method delegates to the respective derived class to calculate the gross pay amount by invoking the abstract `Employee.calcGrossPay()` method.
- The Employee.calcCompensation() method then calculates the FICA, state & local taxes, medicare and social security contributions based on the gross pay. Assume the following fixed tax percentages:
    - FICA is 23%
    - State tax is 5%
    - Local tax is 1%
    - Medicare is 3%
    - Social Security is 7.5%

Other Important implementation details about the UML class diagram:

- Paycheck class objects are immutable, i.e. all data needs to be passed to the constructor and no setter methods should be provided.
- Employee is an abstract class!
- Employee.calcCompensation() returns a Paycheck object!
- Be sure to enforce the multiplicity indicated on the relationship between Commisioned and Order.
- In order to calculate the paycheck for a Commissioned employee you need to access all the Order objects that each Commissioned employee is responsible for and add up the order amount of all orders during a given month.

Testing your code:

- Inside a test package write a Main class with a Main method that test your system by creating a list of 4 Employees, one hourly, one salaried, and two commissioned. Where the first commissioned employee has at least one order, and the second at least two.
- Your main should then go through the list, getting the Paycheck for each employee, and calling the print() method on it.
- Check that the output is what you expected it to be for each employee.

Lab 4, Optional Part B

[March 2017 Programming Exam Question]

In a company, employees may have multiple bank accounts: zero or more savings accounts and zero or more checking accounts. Each checking account has an account id, a balance, and a monthly fee. Each savings account has an account id, a balance, and an interest rate associated with the particular type of savings account. It is possible to read the current balance in any of these accounts, but it is also possible to determine the balance after interest or monthly fee is applied by calling the `computeUpdatedBalance` method on the account.

An administrator has access to all employee records and from time to time computes the total balance across all employee-owned accounts; for each account, the balance that is needed in this computation is the *updated balance*. This computation is performed in the static method

`computeUpdatedBalanceSum`

in the `Admin` class.

Below is a class diagram showing the classes involved and relationships between them. A sequence diagram for the operation `computeUpdatedBalanceSum` is also provided. Your task in this problem is to write Java code that implements the classes and relationships shown in the diagram. Shells for the `Admin` and the `Employee` classes have been provided in your workspace. Also, a `Main` class (with a `main` method) has been provided for you to test your code (in the `launch` package) – the code in the `main` method has been commented out; when you are ready to test your code, you can uncomment it.

The method `computeUpdatedBalance` in `CheckingAccount` does the following computation to obtain the return value:

```
balance – monthlyFee.
```

The method `computeUpdatedBalance` in `SavingsAccount` performs the following computation to obtain the return value:

```
balance + (interestRate * balance).
```

Points to notice about the class diagram:

1. `CheckingAccount` and `SavingsAccount` are subclasses of `Account`. Also, `Account` has several abstract methods which must be implemented in its subclasses.
2. There is a one-way association from `Employee` to `Account`. It is important that your code reflects and maintains this association.
3. The diagram has a mix of dependencies and associations; make sure your code distinguishes between these properly.

You may not modify the signatures or qualifiers of the methods contained in the `Admin` or `Employee` classes that have been provided. You will need to create all the other classes mentioned in the diagrams.

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