Marco Martinez
CISP 401
Assignment 4

Hierarchy Chart

```
   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      IntegerDataItem
      StringDataItem
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      IntegerDataItem(1) --- inherits --- (1) GenericItemType
      StringDataItem(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainerClasses

   GenericContainer
      CLASS CONSTRUCTOR
         (+) GenericContainer()
         (+) GenericContainer(int size)
         (+) GenericContainer(GenericContainer gc)

      CHANGE STATE SERVICES
         (+) void init()
         (+) void add(GenericItemType git)
         (+) void remove(GenericItemType git)
         (+) GenericItemType search(GenericItemType key)
         (-) GenericItemType biSearch(GenericItemType key,int low,int high)
         (+) void sort()
         (-) void qSort(int start, int finish)
         (+) void Iterator_Initialize()
```

```
READ STATE SERVICES
      (+) int getMax()
      (+) int getLength()
      (+) int getCurrentIndex()
      (+) GenericItemType get(int i)
      (+) boolean Iterator_hasNext()
      (+) GenericItemType Iterator_getNext()
```

GenericItemType

```
   (+) Abstract boolean isLess(GenericItemType)
   (+) Abstract boolean isEqual(GenericItemType)
   (+) Abstract boolean isGreater(GenericItemType)
```

IntegerDataItem

```
   INSTANCE VARIABLE DECLARATION
      (-) int myValue;

   CLASS CONSTRUCTORS
      (+) IntegerDataItem()
      (+) IntegerDataItem(int i)
      (+) IntegerDataItem(IntegerDataItem idi)

   CHANGE STATE SERVICES
      (+) void set(int i)

   READ STATE SERVICES
      (+) boolean isLess(GenericItemType git)
      (+) boolean isEqual(GenericItemType git)
      (+) boolean isGreater(GenericItemType git)
      (+) int get()
      (+) String toString()
```

StringDataItem

```
   INSTANCE VARIABLE DECLARATION
      (-) String myString;

   CLASS CONSTRUCTORS
      (+) StringDataItem()
      (+) StringDataItem(String s)
      (+) StringDataItem(StringDataItem sdi)

   CHANGE STATE SERVICES
      (+) void set(String s)

   READ STATE SERVICES
      (+) boolean isLess(GenericItemType git)
      (+) boolean isEqual(GenericItemType git)
      (+) boolean isGreater(GenericItemType git)
      (+) String get()
      (+) String toString()
```

Employee Class Attributes

```
   CONSTANT DEFINITIONS
   (-) double TAXRATE

   INSTANCE VARIABLES
   (#) EmployeeRecord e


   CHANGE STATE SERVICES
   (+) abstract void calcGross()
   (+) void calcTaxes()
   (+) void calcNet()

   READ STATE SERVICES
   (+) boolean isLess(GenericItemType git)
   (+) boolean isEqual(GenericItemType git)
   (+) boolean isGreater(GenericItemType git)
   (+) EmployeeRecord get()
   (+) String toString()
```

EmployeeRecord Class Attributes

```
   INSTANCE VARIABLES
   (+) String lastName
   (+) String firstName
   (+) double grossPay
   (+) double taxAmt
   (+) double netPay
   (+) int    employeeNumber
   (+) char   type

   CLASS CONSTRUCTORS
   (+) EmployeeRecord()
   (+) EmployeeRecord(String newLastName, String newFirstName, double newGrossPay, char newType)
   (+) EmployeeRecord(EmployeeRecord e)

   READ STATE SERVICES
   (+) String toString()
```

Hourly Class Attributes

```
   CONSTANT DEFINITIONS
   (-) double REGULARHOURS
   (-) double OVERTIMERATE
   (-) char TYPE

   INSTANCE VARIABLE DECLARATIONS
   (-) double hours;
   (-) double rate;
```

```
CLASS CONSTRUCTORS
   (+) Employee()
   (+) Employee(String lastName, String firstName, double hrsWkd, double payRate)
   (+) Employee(EmployeeRecord newEmployeeRecord)
   (+) Employee(Employee newEmployee)

   CHANGE STATE SERVICES
   (+) void calcGross()


   READ STATE SERVICES
   (+) double getRate()
   (+) double getHours()
```

Piece Class Attributes

```
   CONSTANT DEFINITIONS
   (-) char TYPE

   INSTANCE VARIABLE DECLARATION
   (-) double pricePerPiece;
   (-) int    pieces;

   CLASS CONSTRUCTORS
   (+) Piece()
   (+) Piece(String newLastName, String newFirstName, double newPieceRate, int newNumPieces)
   (+) Piece(EmployeeRecord newEmployeeRecord)
   (+) Piece(Employee newEmployee)

   CHANGE STATE SERVICES
   (+) void calcGross()

   READ STATE SERVICES
   (+) double getPrice()
   (+) int getPieces()
```

Salary Class Attributes
```
      CONSTANT DEFINITIONS
      (-) char TYPE = 's';

      INSTANCE VARIABLE DECLARATIONS
      (-) double salary;

      CLASS CONSTRUCTORS
      (+) Piece()
      (+) Piece(String lastName, String firstName, double newSalary)
      (+) Piece(EmployeeRecord newEmployeeRecord)
      (+) Piece(Employee newEmployee)

      CHANGE STATE SERVICES
      (+) void calcGross()

      READ STATE SERVICES
      (+) double getRate()
```

State Model

EmployeeRecord
EmployeeRecord() → s(null)
EmployeeRecord(String, String, double, double) → s0
EmployeeRecord(EmployeeRecord) → s0
s0 → toString() → s(terminal)
Employee
s3 → calcGross() → s3
s3 → calcTax() → s3
s3 → calcNet() → s3
s3 → get() → s(terminal)
s3 → toString() → s(terminal)

Hourly
Hourly() → s(null)
Hourly(String, String, double, double) → s3 // Processes are applied upon creation Hourly(EmployeeRecord) → s3 // Processes are applied upon creation (if applicable)
Hourly(Employee) → s3 // Processes are applied upon creation (if applicable)
s3 → calcGross() → s3
s3 → calcTax() → s3
s3 → calcNet() → s3
s3 → getRate() → s(terminal)
s3 → getHours Salary Salary() → s(null)

Salary
Salary(String, String, double, double) → s3 // Processes are applied upon creation Salary(EmployeeRecord) → s3 // Processes are applied upon creation (if applicable)
Salary(Employee) → s3 // Processes are applied upon creation (if applicable)
s3 → calcGross() → s3
s3 → getPiece() → s(terminal)

GenericContainer
GenericContainer() → s0
GenericContainer(Int) → s0
GenericContainer(GenericContainer) → s0

S0 → init() → s0
S0 → add(GenericItemType) → s0
S0 → remove(GenericItemType) → s0
S0 → search(GenericItermType) → s(Err)
S0 → sort() → s1
S0 → getMax() → s(Terminal)
S0 → getLength() → s(Terminal)
S0 → getCurrentIndex() → s(Terminal)
S0 → get(int) → s(Terminal)
S0 → Iterator_Initialize() → s0
S0 → Iterator_hasNext() → s(Terminal)
S0 → Iterator_getNext() → s(Terminal)

S1 → init() → s0
S1 → add(GenericItemType) → s0
S1 → remove(GenericItemType) → s0
S1 → search(GenericItermType) → s(Err)
S1→ sort() → s1
S1 → getMax() → s(Terminal)
S1 → getLength() → s(Terminal)
S1 → getCurrentIndex() → s(Terminal)
S1 → get(int) → s(Terminal)
S1 → Iterator_Initialize() → s0
S1 → Iterator_hasNext() → s(Terminal)
S1 → Iterator_getNext() → s(Terminal)

Use Case Scenario (Hourly)

Normal Scenario 1:
1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction.
3. User requests the processed values via get() method.
4. User exits application.

Normal Scenario 2:
1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant grossPay calculation.
4. User requests the processed values via get() method.
5. User exits application.

Normal Scenario 3:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant taxAmt calculation.
4. User requests the processed values via get() method.
5. User exits application.

Normal Scenario 4:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant netPay calculation.
4. User requests the processed values via get() method.
5. User exits application.

Normal Scenario 5:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant grossPay calculation.
4. User requests redundant taxAmt calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 6:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant taxAmt calculation.
4. User requests redundant grossPay calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 7:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant grossPay calculation.
4. User requests redundant netPay calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 8:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant taxAmt calculation.
4. User requests redundant netPay calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 9:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant netPay calculation.
4. User requests redundant taxAmt calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 10:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant netPay calculation.
4. User requests redundant grossPay calculation.
5. User requests the processed values via get() method.
6. User exits application.

Normal Scenario 11:

1. User inputs 2 String values and 2 double values.
2. Processes are applied upon construction of object.
3. User requests redundant grossPay calculation.
4. User requests redundant taxAmt calculation.
5. User requests redundant netPay calculation.
6. User requests the processed values via get() method.
7. User exits application.

Abnormal Scenario 1:

1. User inputs 2 String values and 2 double values as newLastName, newFirstName, newHrsWkd, newPayRate.
2. Constructor recognizes newLastName as invalid (not alphanumerical).
3. Constructor assigns an uninitialized EmployeeRecord to e.
4. User requests processed information via get() method and is returned null values.
5. User exits program.

Abnormal Scenario 2:

1. User inputs 2 String values and 2 double values as newLastName, newFirstName, newHrsWkd, newPayRate.
2. Constructor recognizes newFirstName as invalid (not alphanumerical).
3. Constructor assigns an uninitialized EmployeeRecord to e.
4. User requests processed information via get() method and is returned null values.
5. User exits program.

Abnormal Scenario 3:

1. User inputs 2 String values and 2 double values as newLastName, newFirstName, newHrsWkd, newPayRate.
2. Constructor recognizes newHrsWkd as invalid (less than 0).
3. Constructor assigns an uninitialized EmployeeRecord to e.
4. User requests processed information via get() method and is returned null values.
5. User exits program.

Abnormal Scenario 4:

1. User inputs 2 String values and 2 double values as newLastName, newFirstName, newHrsWkd, newPayRate.
2. Constructor recognizes newPayRate as invalid (less than 0).
3. Constructor assigns an uninitialized EmployeeRecord to e.
4. User requests processed information via get() method and is returned null values.
5. User exits program.

Java Source Code

```
/**
   @author       Marco Martinez
   @fileName     GenericContainer.java
   @version      1.0
   @description  This program will construct and manipulate GenericContainer objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      IntegerDataItem(1) --- inherits --- (1) GenericItemType
      StringDataItem(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainerClasses

   GenericContainer
      CLASS CONSTRUCTOR
         (+) GenericContainer()
         (+) GenericContainer(int size)
         (+) GenericContainer(GenericContainer gc)

      CHANGE STATE SERVICES
         (+) void init()
         (+) void add(GenericItemType git)]
         (+) void remove(GenericItemType git)
         (+) GenericItemType search(GenericItemType key)
         (-) GenericItemType biSearch(GenericItemType key,int low,int high)
         (+) void sort()
         (-) void qSort(int start, int finish)
         (+) void Iterator_Initialize()
         (+) boolean Iterator_hasNext()
         (+) GenericItemType Iterator_getNext()

   @date         12/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    12/12    Create baseline for GenericContainer.
 */

public class GenericContainer
{
   // INSTANCE VARIABLE DECLARATION
   private final int MAXSIZE = 30;
   private int sizeLimit,
               index,
               currentIndex;
   private GenericItemType[] collection;

   // CLASS CONSTRUCTORS
   // (+) GenericContainer()
   public GenericContainer()
   {
      this.collection = new GenericItemType[MAXSIZE];
      this.sizeLimit = MAXSIZE;
      this.currentIndex = 0;
   }

   // (+) GenericContainer(int size)
   public GenericContainer(int size)
   {
      this.currentIndex = 0;
      if (size <= MAXSIZE)
         this.sizeLimit = size;
      else
         this.sizeLimit = MAXSIZE;
   }

   // (+) GenericContainer(GenericContainer gc)
   public GenericContainer(GenericContainer gc)
   {
      this.currentIndex = this.index = 0;
      gc.Iterator_Initialize();
      while (gc.Iterator_hasNext())
      {
         this.collection[this.currentIndex] = gc.Iterator_getNext();
         this.index++;
      }
   }
```

```
// CHANGE STATE SERVICES
// (+) void init()
public void init()
{
   Iterator_Initialize();
   while (Iterator_hasNext())
      this.collection[this.currentIndex] = null;
}

// (+) void add(GenericItemType git)
public void add(GenericItemType git)
{
   this.collection[this.index++] = git;
}

// (+) void remove(GenericItemType git)
public void remove(GenericItemType git)
{
   Iterator_Initialize();
   GenericItemType temp;
   while (Iterator_hasNext())
   {
      temp = Iterator_getNext();
      if (temp.isEqual(git))
      {
         this.collection[this.currentIndex-1] = this.collection[this.index-1];
         this.collection[this.index-1] = new IntegerDataItem();
         this.index--;
         return;
      }
   }
}

// (+) GenericItemType search(GenericItemType key)
public GenericItemType search(GenericItemType key)
{
   return biSearch(key,0,this.index);
}

// (-)  GenericItemType biSearch(GenericItemType key,int low,int high)
private GenericItemType biSearch(GenericItemType key,int low,int high)
{
   while(high >= low)
   {
      int middle = (low + high) / 2;
      if (collection[middle].isEqual(key))
      {
         return collection[middle];
      }
      if (collection[middle].isGreater(key))
      {
         return biSearch(key, low, middle-1);
      }
      if (collection[middle].isLess(key))
      {
         return biSearch(key, middle+1, high);
      }
   }
   return new StringDataItem();
}

// (+) void sort()
public void sort()
{
   if (this.index > 0) qSort(0, this.index-1);
}

// (-)  void qSort(int start, int finish)
private void qSort(int start, int finish)
{
   int i = start;
   int j = finish;
   GenericItemType pivot = this.collection[start + (finish - start) / 2];

   while (i <= j)
   {
      while (this.collection[i].isLess(pivot))
      {
         i++;
      }

      while (this.collection[j].isGreater(pivot))
      {
         j--;
      }

      if (i <= j)
      {
         GenericItemType temp = this.collection[i];
         this.collection[i] = this.collection[j];
         this.collection[j] = temp;
         i++;
         j--;
      }
   }

   if (start < j)
   {
         qSort(start, j);
   }
   if (i < finish)
   {
         qSort(i, finish);
   }
}

// (+) int getMax()
public int getMax()
{
   if (this.sizeLimit != 0)
      return sizeLimit;
   else
      return MAXSIZE;
}

// (+) int getLength()
public int getLength()
{
   return this.index;
}

// (+) int getCurrentIndex()
public int getCurrentIndex()
{
   return this.currentIndex;
}

// (+) GenericItemType get(int i)
public GenericItemType get(int i)
{
   return this.collection[i];
}

// (+) void Iterator_Initialize()
public void Iterator_Initialize()
{
   this.currentIndex = 0;
}

// (+) boolean Iterator_hasNext()
public boolean Iterator_hasNext()
{
   return this.currentIndex <= this.index-1;
}

// (+) GenericItemType Iterator_getNext()
public GenericItemType Iterator_getNext()
{
   return this.collection[this.currentIndex++];
}
}
```

```
/**
   @author       Marco Martinez
   @fileName     GenericItemType.java
   @version      1.0
   @description  This program will construct and manipulate GenericItemType objects.

   Classes
      GenericItemType
      IntegerDataType
      StringDataType
      GenericContainer
      AppDriver

   Associations
      IntegerDataType --- 1 : 1 (inherits) ---> GenericItempType
      StringDataType --- 1 : 1 (inherits) ---> GenericItemType
      GenericContainer --- 1 : m (contains) ---> GenericItemType
      AppDriver --- 1 : 1 (uses) ---> GenericContainer

   GenericItemType // is an abstract class
      (+) Abstract boolean isLess(GenericItemType)
      (+) Abstract boolean isEqual(GenericItemType)
      (+) Abstract boolean isGreater(GenericItemType)


   @date         10/11/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    12/12    Create baseline for GenericItemType.
 */

public abstract class GenericItemType
{
   // (+) abstract boolean isLess(GenericItemType git)
   public abstract boolean isLess(GenericItemType git);

   // (+) abstract boolean isEqual(GenericItemType git)
   public abstract boolean isEqual(GenericItemType git);

   // (+) abstract boolean isGreater(GenericItemType git)
   public abstract boolean isGreater(GenericItemType git);
}

/**
   @author       Marco Martinez
   @fileName     GenericItemType.java
   @version      1.0
   @description  This program will construct and manipulate IntegerDataType objects.
   Classes
      GenericItemType
      IntegerDataType
      StringDataType
      GenericContainer
      AppDriver

   Associations
      IntegerDataType --- 1 : 1 (inherits) ---> GenericItempType
      StringDataType --- 1 : 1 (inherits) ---> GenericItemType
      GenericContainer --- 1 : m (contains) ---> GenericItemType
      AppDriver --- 1 : 1 (uses) ---> GenericContainer

   IntegerDataItem
      INSTANCE VARIABLE DECLARATION
         (-) int myValue;

      CLASS CONSTRUCTORS
         (+) IntegerDataItem()
         (+) IntegerDataItem(int i)
         (+) IntegerDataItem(IntegerDataItem idi)

      CHANGE STATE SERVICES
         (+) void set(int i)

      READ STATE SERVICES
         (+) boolean isLess(GenericItemType git)
         (+) boolean isEqual(GenericItemType git)
         (+) boolean isGreater(GenericItemType git)
         (+) int get()
         (+) String toString()


   @date         12/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    12/12    Create baseline for IntegerDataType.
 */

public class IntegerDataItem extends GenericItemType
{
   // INSTANCE VARIABLE DECLARATION
   private int myValue;

   //CLASS CONSTRUCTORS
   // (+) IntegerDataItem()
   public IntegerDataItem(){}

   // (+) IntegerDataItem(int i)
```

```
    public IntegerDataItem(int i)
    {
       set(i);
    }

    // (+) IntegerDataItem(IntegerDataItem idi)
    public IntegerDataItem(IntegerDataItem idi)
    {
       set(idi.get());
    }

    // CHANGE STATE SERVICES
    // (+) void set(int i)
    public void set(int i)
    {
       myValue = i;
    }

    // READ STATE SERVICES
    // (+) boolean isLess(GenericItemType git)
    public boolean isLess(GenericItemType git)
    {
       return (myValue < ((IntegerDataItem) git).get());
    }

    // (+) boolean isEqual(GenericItemType git)
    public boolean isEqual(GenericItemType git)
    {
       return (myValue == ((IntegerDataItem) git).get());
    }

    // (+) boolean isGreater(GenericItemType git)
    public boolean isGreater(GenericItemType git)
    {
       return (myValue > ((IntegerDataItem) git).get());
    }

    // (+) int get()
    public int get()
    {
       return myValue;
    }

    // (+) String toString()
    public String toString()
    {
       return Integer.toString(myValue);
    }
}
```

```java
/**
   @author       Marco Martinez
   @fileName     StringDataItem.java
   @version      1.0
   @description  This program will construct and manipulate StringDataItem objects.

   Classes
      GenericItemType
      IntegerDataType
      StringDataType
      GenericContainer
      AppDriver

   Associations
      IntegerDataType --- 1 : 1 (inherits) ---> GenericItempType
      StringDataType --- 1 : 1 (inherits) ---> GenericItemType
      GenericContainer --- 1 : m (contains) ---> GenericItemType
      AppDriver --- 1 : 1 (uses) ---> GenericContainer

   StringDataItem
      INSTANCE VARIABLE DECLARATION
         (-) String myString;

      CLASS CONSTRUCTORS
         (+) StringDataItem()
         (+) StringDataItem(String s)
         (+) StringDataItem(StringDataItem sdi)

      CHANGE STATE SERVICES
         (+) void set(String s)

      READ STATE SERVICES
         (+) boolean isLess(GenericItemType git)
         (+) boolean isEqual(GenericItemType git)
         (+) boolean isGreater(GenericItemType git)
         (+) String get()
         (+) String toString()

   @date         12/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    12/12    Create baseline for StringDataItem.
 */

public class StringDataItem extends GenericItemType
{
   // INSTANCE VARIABLE DECLARATION
   private String myString;
```

```
// CLASS CONSTRUCTORS
// (+) StringDataItem()
public StringDataItem(){}

// (+) StringDataItem(String s)
public StringDataItem(String s)
{
   myString = new String(s);
}

// (+) StringDataItem(StringDataItem sdi)
public StringDataItem(StringDataItem sdi)
{
   set(sdi.get());
}

// CHANGE STATE SERVICES
// (+) void set(String s)
public void set(String s)
{
   myString = s;
}

// READ STATE SERVICES
// (+) boolean isLess(GenericItemType git)
public boolean isLess(GenericItemType git)
{
   return ( myString.compareTo(((StringDataItem) git).get()) < 0);
}

// (+) boolean isEqual(GenericItemType git)
public boolean isEqual(GenericItemType git)
{
   return ( myString.compareTo(((StringDataItem) git).get()) == 0);
}

// (+) boolean isGreater(GenericItemType git)
public boolean isGreater(GenericItemType git)
{
   return ( myString.compareTo(((StringDataItem) git).get()) > 0);
}

// (+) String get()
public String get()
{
   return myString;
}

// (+) String toString()
public String toString()
{
      return "Value of myString: " + myString;
   }
}

/**
   @author       Marco Martinez
   @fileName     EmployeeRecord.java
   @version      1.1
   @description  This program will construct and manipulate EmployeeRecord objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   EmployeeRecord Class Attributes
      INSTANCE VARIABLES
      (+) String lastName
      (+) String firstName
      (+) double grossPay
      (+) double taxAmt
      (+) double netPay
      (+) int    employeeNumber
      (+) char   type

      CLASS CONSTRUCTORS
      (+) EmployeeRecord()
      (+) EmployeeRecord(String newLastName, String newFirstName, double newGrossPay, char newType)
      (+) EmployeeRecord(EmployeeRecord e)

      READ STATE SERVICES
      (+) String toString()

   @date         10/11/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    10/11    Create baseline for EmployeeRecord.
   Marco    11/12    Adjust for inheritance.
 */

public class EmployeeRecord
{
   // INSTANCE VARIABLE DECLARATIONS
   public String lastName,
                 firstName;
   public double grossPay,
                 taxAmt,
                 netPay;
   public int    employeeNumber;
   public char   type;

   // CLASS CONSTRUCTORS
   // (+) EmployeeRecord()
   public EmployeeRecord(){}

   // (+) EmployeeRecord(String newLastName, String newFirstName, char newType)
   public EmployeeRecord(String newLastName, String newFirstName, char newType)
   {
      if ((Character.toLowerCase(newType) != 'h' && Character.toLowerCase(newType) != 'p' && Character.toLowerCase(newType) != 's') ||
!newLastName.matches("[a-zA-Z]+") || !newFirstName.matches("[a-zA-Z]+")) return;
      else
      {
         this.lastName = newLastName;
         this.firstName = newFirstName;
         this.type = newType;
         this.grossPay = this.taxAmt = this.netPay = 0.00;
      }
   }

   // (+) EmployeeRecord(EmployeeRecord newEmployeeRecord)
   public EmployeeRecord(EmployeeRecord newEmployeeRecord)
   {
      this.lastName = newEmployeeRecord.lastName;
      this.firstName = newEmployeeRecord.firstName;
      this.grossPay = newEmployeeRecord.grossPay;
      this.taxAmt = newEmployeeRecord.taxAmt;
      this.netPay = newEmployeeRecord.netPay;
      this.employeeNumber = newEmployeeRecord.employeeNumber;
      this.type = newEmployeeRecord.type;
   }

   // READ STATE SERVICES
   // (+) String toString()
   public String toString()
   {
      return this.lastName + ", " + this.firstName
                           + " " + Double.toString(this.grossPay)
                           + " " + Double.toString(this.taxAmt)
                           + " " + Double.toString(this.netPay);
   }
}

/**
   @author       Marco Martinez
   @fileName     Employee.java
   @version      1.0
   @description  This program will construct and manipulate Employee objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   Employee Class Attributes
      CONSTANT DEFINITIONS
      (-) double TAXRATE

      INSTANCE VARIABLES
      (#) EmployeeRecord e

      CHANGE STATE SERVICES
      (+) abstract void calcGross()
      (+) void calcTaxes()
      (+) void calcNet()

      READ STATE SERVICES
      (+) EmployeeRecord get()
      (+) String toString()

   @date         10/11/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    10/11    Create baseline for Employee.
   Marco    11/12    Adjust for inheritance.
 */

public abstract class Employee extends GenericItemType
{
   // CONSTANT DEFINITIONS
   private static final double TAXRATE = 0.15;

   // INSTANCE VARIABLE DECLARATIONS
   protected EmployeeRecord e;

   // CLASS CONSTRUCTORS
   // (+) Employee()
   public Employee(){}

   // (+) Employee(String newLastName, String newFirstName, char newType)
   public Employee(String newLastName, String newFirstName, char newType)
   {
      if ((Character.toLowerCase(newType) != 'h' && Character.toLowerCase(newType) != 'p' && Character.toLowerCase(newType) != 's') ||
!newLastName.matches("[a-zA-Z]+") || !newFirstName.matches("[a-zA-Z]+")) this.e = new EmployeeRecord();
      else
      {
         this.e = new EmployeeRecord(newLastName, newFirstName, newType);
      }
   }

   // (+) Employee(EmployeeRecord newEmployeeRecord)
   public Employee(EmployeeRecord newEmployeeRecord)
   {
      this.e = new EmployeeRecord(newEmployeeRecord);
      if (this.e.grossPay == 0) calcGross();
      if (this.e.taxAmt == 0) calcTax();
      if (this.e.netPay == 0) calcNet();
   }

   // (+) Employee(Employee newEmployee)
   public Employee(Employee newEmployee)
   {
      this.e = new EmployeeRecord(newEmployee.get());
      if (this.e.grossPay == 0) calcGross();
      if (this.e.taxAmt == 0) calcTax();
      if (this.e.netPay == 0) calcNet();
   }

   // CHANGE STATE SERVICES
   // (+) abstract void calcGross()
   public abstract void calcGross();

   // (+) void calcTax()
   public void calcTax()
   {
      this.e.taxAmt = this.e.grossPay * TAXRATE;
   }

   // (+) void calcNet()
   public void calcNet()
   {
      this.e.netPay = this.e.grossPay - this.e.taxAmt;
   }

   // READ STATE SERVICES
   // (+) boolean isLess(GenericItemType git)
   public boolean isLess(GenericItemType git)
   {
      if(this.e.lastName.compareToIgnoreCase(((Employee)(git)).get().lastName) < 0)
         return true;
      else
         return false;
   }

   // (+) boolean isEqual(GenericItemType git)
   public boolean isEqual(GenericItemType git)
   {
      if(this.e.lastName.compareToIgnoreCase(((Employee)(git)).get().lastName) == 0)
         return true;
      else
         return false;
   }

   // (+) boolean isGreater(GenericItemType git)
   public boolean isGreater(GenericItemType git)
   {
      if(this.e.lastName.compareToIgnoreCase(((Employee)(git)).get().lastName) > 0)
         return true;
      else
         return false;
   }

   // (+) EmployeeRecord get()
   public EmployeeRecord get()
   {
      return this.e;
   }

   // (+) String toString()
   public String toString()
   {
      return this.e.toString();
   }
}
```

```
/**
   @author       Marco Martinez
   @fileName     Hourly.java
   @version      1.0
   @description  This program will construct and manipulate Hourly-Employee objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   Hourly Class Attributes
      CONSTANT DEFINITIONS
      (-) double REGULARHOURS
      (-) double OVERTIMERATE
      (-) char TYPE

      INSTANCE VARIABLE DECLARATIONS
      (-) double hours;
      (-) double rate;

      CLASS CONSTRUCTORS
      (+) Employee()
      (+) Employee(String lastName, String firstName, double hrsWkd, double payRate)
      (+) Employee(EmployeeRecord newEmployeeRecord)
      (+) Employee(Employee newEmployee)

      CHANGE STATE SERVICES
      (+) void calcGross()

      READ STATE SERVICES
      (+) double getRate()
      (+) double getHours()

   @date         11/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    11/12    Create baseline for Hourly.
 */

public class Hourly extends Employee
{
   // CONSTANT DEFINITIONS
   private static final double REGULARHOURS = 40.0;
   private static final double OVERTIMERATE = 1.5;
   private static final char TYPE = 'h';

   // INSTANCE VARIABLE DECLARATIONS
   private double hours;
   private double rate;

   // CLASS CONSTRUCTORS
   // (+) Hourly()
   public Hourly(){}

   // (+) Hourly(String newLastName, String newFirstName, double newPayRate, double newHrsWkd)
   public Hourly(String newLastName, String newFirstName, double newPayRate, double newHrsWkd)
   {
      super(newLastName, newFirstName, TYPE);
      if (newPayRate < 0 || newHrsWkd < 0)
      {
         this.e = new EmployeeRecord();
         return;
      }
      else
      {
         this.rate = newPayRate;
         this.hours = newHrsWkd;
         calcGross();
         calcTax();
         calcNet();
      }
   }

   // (+) Hourly(EmployeeRecord newEmployee)
   public Hourly(EmployeeRecord newEmployee)
   {
      super(newEmployee);
   }

   // (+) Hourly(Employee newEmployee)
   public Hourly(Employee newEmployee)
   {
      super(newEmployee);
      this.rate = ((Hourly)newEmployee).getRate();
      this.hours = ((Hourly)newEmployee).getHours();
   }
   // CHANGE STATE SERVICES
   // (+) void calcGross()
   public void calcGross()
   {
      if (this.hours <= REGULARHOURS)
      {
         this.e.grossPay = this.rate * this.hours;
      }
      else
      {
         this.e.grossPay = REGULARHOURS * this.rate;
         this.e.grossPay += (this.hours - REGULARHOURS) * this.rate * OVERTIMERATE;
      }
   }

   // READ STATE SERVICES
   // (+) double getRate()
   public double getRate()
   {
      return this.rate;
   }

   // (+) double getHours()
   public double getHours()
   {
      return this.hours;
   }
}

/**
   @author       Marco Martinez
   @fileName     Piece.java
   @version      1.0
   @description  This program will construct and manipulate Piece-Employee objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   Piece Class Attributes
      CONSTANT DEFINITIONS
      (-) char TYPE

      INSTANCE VARIABLE DECLARATION
      (-) double pricePerPiece;
      (-) int    pieces;

      CLASS CONSTRUCTORS
      (+) Piece()
      (+) Piece(String newLastName, String newFirstName, double newPieceRate, int newNumPieces)
      (+) Piece(EmployeeRecord newEmployeeRecord)
      (+) Piece(Employee newEmployee)

      CHANGE STATE SERVICES
      (+) void calcGross()

      READ STATE SERVICES
      (+) double getPrice()
      (+) int getPieces()

   @date         11/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    11/12    Create baseline for Piece.
 */

public class Piece extends Employee
{
   // CONSTANT DEFINITIONS
   private static final char TYPE = 'p';

   // INSTANCE VARIABLE DECLARATION
   private double pricePerPiece;
   private int    pieces;

   // CLASS CONSTRUCTORS
   // (+) Piece()
   public Piece(){}

   // (+) Piece(String newLastName, String newFirstName, double newPieceRate, int newNumPieces)
   public Piece(String newLastName, String newFirstName, double newPieceRate, int newNumPieces)
   {
      super(newLastName, newFirstName, TYPE);
      if (newPieceRate < 0 || newNumPieces < 0)
      {
         this.e = new EmployeeRecord();
         return;
      }
      else
      {
         this.pricePerPiece = newPieceRate;
         this.pieces = newNumPieces;
         calcGross();
         calcTax();
         calcNet();
      }
   }

   // (+) Piece(EmployeeRecord newEmployee)
   public Piece(EmployeeRecord newEmployee)
   {
      super(newEmployee);
   }

   // (+) Piece(Employee newEmployee)
   public Piece(Employee newEmployee)
   {
      super(newEmployee);
      this.pricePerPiece = ((Piece)newEmployee).getPrice();
      this.pieces = ((Piece)newEmployee).getPieces();
   }

   // CHANGE STATE SERVICES
   // (+) void calcGross()
   public void calcGross()
   {
      this.e.grossPay = this.pricePerPiece * this.pieces;
   }

   // READ STATE SERVICES
   // (+) double getPrice()
   public double getPrice()
   {
      return this.pricePerPiece;
   }

   // (+) int getPieces()
   public int getPieces()
   {
      return pieces;
   }
}
/**
   @author       Marco Martinez
   @fileName     Salary.java
   @version      1.0
   @description  This program will construct and manipulate Salary-Employee objects.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   Salary Class Attributes
      CONSTANT DEFINITIONS
      (-) char TYPE = 's';

      INSTANCE VARIABLE DECLARATIONS
      (-) double salary;

      CLASS CONSTRUCTORS
      (+) Piece()
      (+) Piece(String lastName, String firstName, double newSalary)
      (+) Piece(EmployeeRecord newEmployeeRecord)
      (+) Piece(Employee newEmployee)

      CHANGE STATE SERVICES
      (+) void calcGross()

      READ STATE SERVICES
      (+) double getRate()

   @date         11/12/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    11/12    Create baseline for Piece.
 */

public class Salary extends Employee
{
   // CONSTANT DEFINITIONS
   private static final char TYPE = 's';
```

```
// INSTANCE VARIABLE DECLARATIONS
private double salary;

// CLASS CONSTRUCTORS
// (+) Salary()
public Salary(){}

// (+) Salary(String newLastName, String newFirstName, double newSalary)
public Salary(String newLastName, String newFirstName, double newSalary)
{
   super(newLastName, newFirstName, TYPE);
   if (newSalary < 0)
   {
      this.e = new EmployeeRecord();
      return;
   }
   else
   {
      this.salary = newSalary;
      calcGross();
      calcTax();
      calcNet();
   }
}

// (+) Salary(EmployeeRecord newEmployee)
public Salary(EmployeeRecord newEmployee)
{
   super(newEmployee);
}

// (+) Salary(Employee newEmployee)
public Salary(Employee newEmployee)
{
   super(newEmployee);
   this.salary = ((Salary)newEmployee).getSalary();
}

// CHANGE STATE SERVICES
// (+) void calcGross()
public void calcGross()
{
   this.e.grossPay = this.salary;
}

// READ STATE SERVICES
// (+) double getSalary()
public double getSalary()
{
   return this.salary;
   }
}

/**
         GenericItemType // is an abstract class
           (+) abstract boolean isLess(GenericItemType)
           (+) abstract boolean isEqual(GenericItemType)
           (+) abstract boolean isGreater(GenericItemType)

         IntegerDataType --- 1 :  1 (inherits) ---> GenericItemType
           (+) all constructors
           (+) boolean isLess(GenericItemType) // overrides of base method
           (+) boolean isEqual(GenericItemType)
           (+) boolean isGreater(GenericItemType)
           (+) accessors (get(), toString())
           (+) manipulators

         StringDataType --- 1 :  1 (inherits) ---> GenericItemType
           (+) boolean isLess(GenericItemType) // override of base method
           (+) boolean isEqual(GenericItemType)
           (+) boolean isGreater(GenericItemType)

         GenericContainer --- 1 :  m (contains) --- GenericItemType
*/

public class Main
{
   public static void main(String[] args)
   {
       GenericContainer gC = new GenericContainer();

       gC.add(new IntegerDataItem(13));
       gC.add(new IntegerDataItem(-30));
       gC.add(new IntegerDataItem(100));
       gC.add(new IntegerDataItem(70));
       gC.add(new IntegerDataItem(45));
       gC.sort();
       System.out.printf("    Sorted Integer Collection\n");
       gC.Iterator_Initialize();
       while (gC.Iterator_hasNext())  {
          IntegerDataItem nextOne = (IntegerDataItem )(gC.Iterator_getNext());
          System.out.printf("  %5d", nextOne.get());
          if (!(gC.Iterator_hasNext())) System.out.printf("\n\n");
       }
       GenericContainer sgC= new GenericContainer();
       sgC.add(new StringDataItem("Johnson"));
       sgC.add(new StringDataItem("Dixon"));
       sgC.add(new StringDataItem("Adams"));
       sgC.add(new StringDataItem("Baker"));
       sgC.add(new StringDataItem("Lee"));
       sgC.add(new StringDataItem("Camille"));
```

```
      sgC.sort();
      System.out.printf("    Sorted string Collection\n");
      System.out.print("  ");
      sgC.Iterator_Initialize();
      while (sgC.Iterator_hasNext())  {
         StringDataItem nextOne = (StringDataItem) (sgC.Iterator_getNext());
         System.out.printf("  %s", nextOne.get());
         if (!(sgC.Iterator_hasNext())) System.out.printf("\n");
      }
   } // main
} // class

/**
   @author       Marco Martinez
   @fileName     AppDriver.java
   @version      1.0
   @description  This program will utilize GenericContainer objects for creating a report.

   Classes
      EmployeeRecord
      Employee
      Hourly
      Salary
      Piece
      GenericItemType
      GenericContainer
      AppDriver

   Associations
      Employee(1) --- inherits --- (1) GenericItemType
      Hourly(1) --- inherits --- (1) Employee
      Salary(1) --- inherits --- (1) Employee
      Piece(1) --- inherits --- (1) Employee
      GenericContainer(1) --- contains --- (m) GenericItemType
      AppDriver(1) --- uses --- (1) GenericContainer

   AppDriver Class
      (+) static void getEmployees(GenericContainer myEmps)
      (+) static void getEmployee(GenericContainer myEmps, String payPrompt, String numOfPrompt, char tempType, Scanner input)
      (-) static Employee determineEmployee(String lastName, String firstName, double payRate, double hrsWkd, char c)
      (+) static char validateAnswer(char c, Scanner input)
      (+) static String validateString(String name, Scanner input)
      (+) static double validateDouble(double value, Scanner input)
      (+) static char validateYesNo(char c, Scanner input)
      (+) static void printReport(GenericContainer myEmps)
      (+) static void printHeading()
      (+) static void printLabels()
      (+) static void printEmployees(GenericContainer myEmps)
      (+) static boolean determineIfTypeExists(GenericContainer, char type)
      (+) static void printEmployee(EmployeeRecord emp, String str, char type)
      (+) static void printTypeFooter(GenericContainer myEmps, char type)
      (+) static void printTotals(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, char type)
      (+) static void printAverages(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, int empNum, char
type)
      (+) static void printFooter(GenericContainer myEmps)
      (+) static void printString38(String str)
      (+) static void printString12(String str)
      (+) static void printDouble12(double value)
      (+) static String concatenateName(String lastName, String firstName)


   @date         10/11/2018

   Program Change Log
   ==========================
   Name     Date     Description
   Marco    10/11    Create baseline for AppDriver.
   Marco    10/28    Add finishing touches to AppDriver.
   Marco    11/13    Adjust for inheritance.
   Marco    12/8     Adjust for feedback. Moved "determineEmployee" method.
   Marco    12/13    Adjusted for generics.
 */
// LIBRARIES
import java.util.Scanner; // Allows access to scanner

public class AppDriver
{
   // CONSTANT DEFINITIONS
   public static final String TYPE_PROMPT = new String("Please enter the employee's type here: ");
   public static final String FIRST_PROMPT = new String("Please enter the employee's first name here: ");
   public static final String LAST_PROMPT = new String("Please enter the employee's last name here: ");
   public static final String HOUR_RATE_PROMPT = new String("Please enter the employee's hourly pay here: ");
   public static final String HOUR_HRS_PROMPT = new String("Please enter the employee's number of worked hours: ");
   public static final String PIECE_RATE_PROMPT = new String("Please enter the employee's pay per piece of work here: ");
   public static final String PIECE_NUM_PROMPT = new String("Please enter the employee's number of pieces here: ");
   public static final String SALARY_PROMPT = new String("Please enter the employee's salary here: ");
   public static final String HOURLY_LABEL_TOP = new String(String.format("%-38s","Employee (Hourly)") + String.format("%12s","Pay") +
String.format("%12s","Hours") + String.format("%12s","Gross") + String.format("%12s","Tax") + String.format("%12s","Net"));
   public static final String HOURLY_LABEL_MIDDLE = new String(String.format("%-38s","Name") + String.format("%12s","Rate") +
String.format("%12s","Worked") + String.format("%12s","Pay") + String.format("%12s","Amount") + String.format("%12s","Pay"));
   public static final String HOURLY_LABEL_BOTTOM = new String(String.format("%-38s","=======") + String.format("%12s","=====") +
String.format("%12s","=====") + String.format("%12s","=====") + String.format("%12s","=====") + String.format("%12s","====="));
   public static final String SALARY_LABEL_TOP = new String(String.format("%-38s","Employee (Salary)") + String.format("%12s","") +
String.format("%12s","") + String.format("%12s","Salary") + String.format("%12s","Tax") + String.format("%12s","Net"));
   public static final String SALARY_LABEL_MIDDLE = new String(String.format("%-38s","Name") + String.format("%12s","") +
String.format("%12s","") + String.format("%12s","Pay") + String.format("%12s","Amount") + String.format("%12s","Pay"));
   public static final String SALARY_LABEL_BOTTOM = new String(String.format("%-38s","====================================") +
String.format("%12s","============") + String.format("%12s","============") + String.format("%12s","=====") + String.format("%12s","=====") +
String.format("%12s","====="));
   public static final String PIECE_LABEL_TOP = new String(String.format("%-38s","Employee (PieceWork)") + String.format("%12s","Pieces") +
String.format("%12s","Price of") + String.format("%12s","Gross") + String.format("%12s","Tax") + String.format("%12s","Net"));
   public static final String PIECE_LABEL_MIDDLE = new String(String.format("%-38s","Name") + String.format("%12s","Sold") +
String.format("%12s","Piece") + String.format("%12s","Pay") + String.format("%12s","Amount") + String.format("%12s","Pay"));
   public static final String PIECE_LABEL_BOTTOM = new String(String.format("%-38s","=======") + String.format("%12s","=====") +
String.format("%12s","=====") + String.format("%12s","=====") + String.format("%12s","=====") + String.format("%12s","====="));

   public static void main(String[] args)
   {
      // VARIABLE DECLARATIONS
      GenericContainer myEmps = new GenericContainer();

      // CALLS
      getEmployees(myEmps);
      myEmps.sort();
      printReport(myEmps);
   }

   // METHODS
   // (+) static void getEmployees(GenericContainer myEmps)
   public static void getEmployees(GenericContainer myEmps)
   {
      Scanner input = new Scanner(System.in);
      char c = 'y';
      char tempType;

      while (c != 'n' && c != 'N')
      {
         System.out.print(TYPE_PROMPT);
         tempType = validateAnswer(Character.toLowerCase(input.next().charAt(0)), input);

         switch (Character.toLowerCase(tempType))
         {
            case 'h':
               getEmployee(myEmps, HOUR_RATE_PROMPT, HOUR_HRS_PROMPT, 'h', input);
               break;
            case 's':
               getEmployee(myEmps, SALARY_PROMPT, "", 's', input);
               break;
            case 'p':
               getEmployee(myEmps, PIECE_RATE_PROMPT, PIECE_NUM_PROMPT, 'p', input);
               break;
            default:
               System.out.println("Error found in getEmployees(Employees) switch statement.");
               break;
         }

         System.out.print("Would you like to continue? (Y/N) ");
         c = validateYesNo((input.next().charAt(0)), input);
         System.out.println();

         if (myEmps.getLength() >= myEmps.getMax() - 1)
         {
            System.out.println("You have hit the maximum amount of employees to enter.");
            c = 'n';
         }
      }
      input.close();
   }

   // (+) static void getEmployee(GenericContainer myEmps, String payPrompt, String numOfPrompt, char c, Scanner input)
   public static void getEmployee(GenericContainer myEmps, String payPrompt, String numOfPrompt, char c, Scanner input)
   {
      String tempFirstName = new String("");
      String tempLastName = new String("");
      Double tempHrsWkd = 0.00;
      Double tempPayRate = 0.00;

      System.out.print(FIRST_PROMPT);
      tempFirstName = validateString(input.next(), input);

      System.out.print(LAST_PROMPT);
      tempLastName = validateString(input.next(), input);

      System.out.print(payPrompt);
      tempPayRate = validateDouble(input.nextDouble(), input);

      if (Character.toLowerCase(c) != 's')
      {
         System.out.print(numOfPrompt);
         tempHrsWkd = validateDouble(input.nextDouble(), input);
      }

      myEmps.add(determineEmployee(tempLastName,tempFirstName,tempPayRate,tempHrsWkd,c));
   }

   // (-)  static Employee determineEmployee(String lastName, String firstName, double payRate, double hrsWkd, char c)
   private static Employee determineEmployee(String lastName, String firstName, double payRate, double hrsWkd, char c)
   {
      switch (c)
      {
         case 'h':
            return new Hourly(lastName, firstName, payRate, hrsWkd);
         case 's':
            return new Salary(lastName, firstName, payRate);
         case 'p':
            return new Piece(lastName, firstName, payRate, (int) hrsWkd);
         default:
            System.out.println("Error found within determineEmployee(String, String, double, double, char) case.");
            break;
      }
      return new Hourly();
   }

   // (+) static char validateAnswer(char c, Scanner input)
```

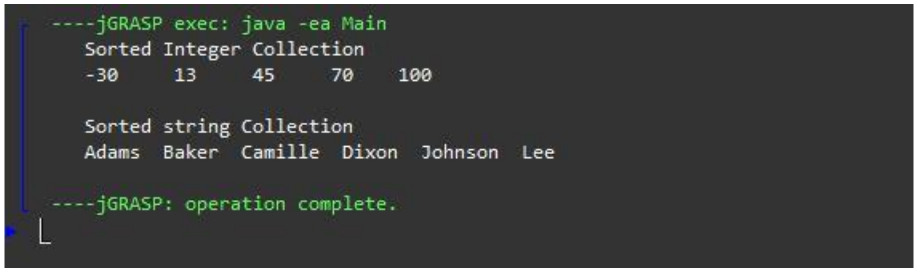
```
public static char validateAnswer(char c, Scanner input)
{
   while (Character.toLowerCase(c) != 'h' && Character.toLowerCase(c) != 's' && Character.toLowerCase(c) != 'p')
   {
      System.out.println("Invalid employee type.");
      System.out.print("Please specify between hourly, piecework or salary: ");
      c = input.next().charAt(0);
   }
   return c;
}

// (+) static String validateString(String name, Scanner input)
public static String validateString(String name, Scanner input)
{
   for(int i = 0; i < 3; i++)
   {
      if (name.matches("[a-zA-Z]+")) return name;
      System.out.println("Error. A name must be alphanumeric.");
      System.out.print("Please enter a name with the correct specifications: ");
      name = input.next();
   }

   return "Default";
}

// (+) static double validateDouble(double value, Scanner input)
public static double validateDouble(double value, Scanner input)
{
   for(int i = 0; i < 3; i++)
   {
      if (value > 0.00) return value;
      System.out.println("Error. Value must be more than 0.");
      System.out.print("Please enter a value with the correct specifications: ");
      value = input.nextDouble();
   }

   return 0.00;
}

// (+) static char validateYesNo(char c, Scanner input)
public static char validateYesNo(char c, Scanner input)
{
   while (c != 'n' && c != 'N' && c != 'y' && c != 'Y')
   {
      System.out.println("Invalid input.");
      System.out.print("Please enter either a 'y' or 'n': ");
      c = input.next().charAt(0);
      System.out.println();
   }
   return c;
}
```

```
// (+) static void printReport(GenericContainer myEmps)
public static void printReport(GenericContainer myEmps)
{
   printHeading();
   printEmployees(myEmps);
   printFooter(myEmps);
}

// (+) static void printHeading()
public static void printHeading()
{
   System.out.println("==================================================================================================");
   System.out.println("                                  YOUR FINANCIAL REPORT ANALYSIS");
   System.out.println("==================================================================================================");
   System.out.println();
}

// (+) static void printEmployees(GenericContainer myEmps)
public static void printEmployees(GenericContainer myEmps)
{
Employee temp;
EmployeeRecord emp;
int counter;
   for(int i = 0; i < 3; i++)
   {
      switch (i)
      {
         case 0:
            if (determineIfTypeExists(myEmps, 'h'))
            {
               System.out.println(HOURLY_LABEL_TOP);
               System.out.println(HOURLY_LABEL_MIDDLE);
               System.out.println(HOURLY_LABEL_BOTTOM);
               while(myEmps.Iterator_hasNext())
               {
                  emp = new EmployeeRecord(((Employee) myEmps.Iterator_getNext()).get());
                  if (emp.type == 'h')
                  {
                     temp = new Hourly((Employee) myEmps.get(myEmps.getCurrentIndex()-1));
                     printEmployee(emp,'h',((Hourly) temp).getRate(),((Hourly) temp).getHours());
                  }
               }
               myEmps.Iterator_Initialize();
               System.out.println();
               printTypeFooter(myEmps,'h');
               System.out.println();
            }
            break;
         case 1:
            if (determineIfTypeExists(myEmps,'s'))
            {
               System.out.println(SALARY_LABEL_TOP);
               System.out.println(SALARY_LABEL_MIDDLE);
               System.out.println(SALARY_LABEL_BOTTOM);
               while(myEmps.Iterator_hasNext())
               {
                  emp = new EmployeeRecord(((Employee) myEmps.Iterator_getNext()).get());
                  if (emp.type == 's')
                  {
                     temp = new Salary((Employee) myEmps.get(myEmps.getCurrentIndex()-1));
                     printEmployee(emp,'s',((Salary) temp).getSalary(), 0.00);
                  }
               }
               myEmps.Iterator_Initialize();
               System.out.println();
               printTypeFooter(myEmps, 's');
               System.out.println();
            }
            break;
         case 2:
            if (determineIfTypeExists(myEmps,'p'))
            {
               System.out.println(PIECE_LABEL_TOP);
               System.out.println(PIECE_LABEL_MIDDLE);
               System.out.println(PIECE_LABEL_BOTTOM);
               while(myEmps.Iterator_hasNext())
               {
                  emp = new EmployeeRecord(((Employee)myEmps.Iterator_getNext()).get());
                  if (emp.type == 'p')
                  {
                     temp = new Piece(((Employee)myEmps.get(myEmps.getCurrentIndex()-1)));
                     printEmployee(emp,'p',((Piece) temp).getPrice(),((Piece) temp).getPieces());
                  }
               }
               myEmps.Iterator_Initialize();
               System.out.println();
               printTypeFooter(myEmps, 'p');
               System.out.println();
            }
            break;
         default:
            System.out.println("Error found within printEmployees(Employees) switch statement.");
            break;
      }
   }
}

// (+) static boolean determineIfTypeExists(GenericContainer myEmps, char type)
public static boolean determineIfTypeExists(GenericContainer myEmps, char type)
{
   EmployeeRecord emp;
   while(myEmps.Iterator_hasNext())
   {
      emp = new EmployeeRecord(((Employee)myEmps.Iterator_getNext()).get());
      if (emp.type == type)
      {
         myEmps.Iterator_Initialize();
         return true;
      }
   }
   myEmps.Iterator_Initialize();
   return false;
}

// (+) static void printEmployee(EmployeeRecord emp, char type, double rate, double quantity)
public static void printEmployee(EmployeeRecord emp, char type, double rate, double quantity)
{
   if (emp.type == type)
   {
      switch (type)
      {
         case 'h':
            printString38(concatenateName(emp.lastName, emp.firstName));
            printDouble12(rate);
            printDouble12(quantity);
            printDouble12(emp.grossPay);
            printDouble12(emp.taxAmt);
            printDouble12(emp.netPay);
            System.out.println();
            break;
         case 's':
            printString38(concatenateName(emp.lastName, emp.firstName));
            printString12("");
            printString12("");
            printDouble12(rate);
            printDouble12(emp.taxAmt);
            printDouble12(emp.netPay);
            System.out.println();
            break;
         case 'p':
            printString38(concatenateName(emp.lastName, emp.firstName));
            printDouble12(rate);
            printDouble12(quantity);
            printDouble12(emp.grossPay);
            printDouble12(emp.taxAmt);
            printDouble12(emp.netPay);
            System.out.println();
            break;
      }
   }
}
```

```
// (+) static void printTypeFooter(GenericContainer myEmps, char type)
public static void printTypeFooter(GenericContainer myEmps, char type)
{
   double totalRate = 0,
          totalQuantity = 0,
          totalGross = 0,
          totalTax = 0,
          totalNet = 0;
   int counter = 0;
   Employee temp;

   while(myEmps.Iterator_hasNext())
   {
      if ((((Employee)(myEmps.Iterator_getNext())).get()).type == type)
      {
         counter++;
         switch (type)
         {
            case 'h':
               temp = new Hourly((Employee)myEmps.get(myEmps.getCurrentIndex()-1));
               totalRate += ((Hourly)temp).getRate();
               totalQuantity += ((Hourly)temp).getHours();
               totalGross += (temp.get()).grossPay;
               totalTax += (temp.get()).taxAmt;
               totalNet += (temp.get()).netPay;
               break;
            case 's':
               temp = new Salary(((Employee)myEmps.get(myEmps.getCurrentIndex()-1)));
               totalRate += ((Salary)temp).getSalary();
               totalGross += (temp.get()).grossPay;
               totalTax += (temp.get()).taxAmt;
               totalNet += (temp.get()).netPay;
               break;
            case 'p':
               temp = new Piece((Employee)myEmps.get(myEmps.getCurrentIndex()-1));
               totalRate += ((Piece)temp).getPrice();
               totalQuantity += ((Piece)temp).getPieces();
               totalGross += (temp.get()).grossPay;
               totalTax += (temp.get()).taxAmt;
               totalNet += (temp.get()).netPay;
               break;
         }
      }
   }
   myEmps.Iterator_Initialize();

   printTotals(totalRate, totalQuantity, totalGross, totalTax, totalNet, type);
   printAverages(totalRate, totalQuantity, totalGross, totalTax, totalNet, counter, type);
}
```

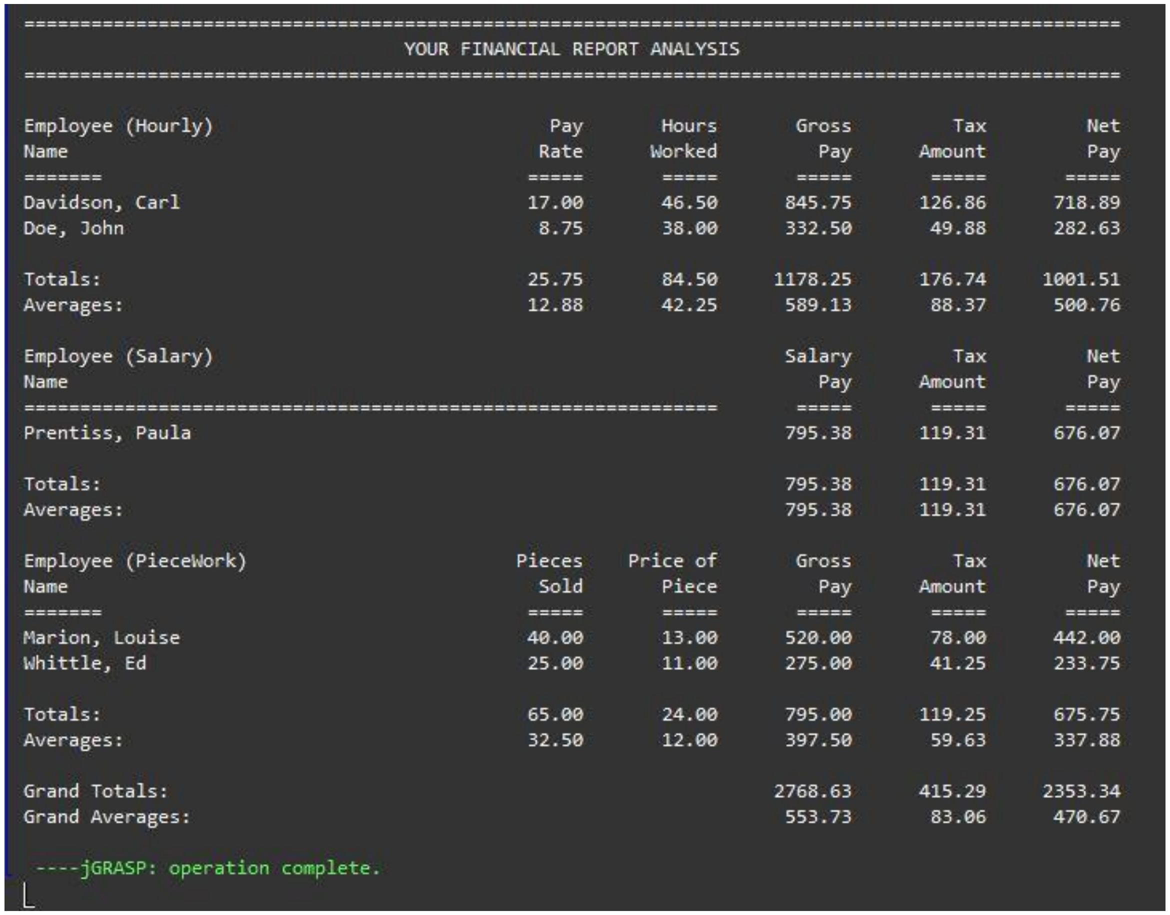
```
   // (+) static void printTotals(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, char type)
   public static void printTotals(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, char type)
   {
      printString38("Totals: ");
      if (type != 's')
      {
         printDouble12(totalRate);
         printDouble12(totalQuantity);
      }
      else
      {
         printString12("");
         printString12("");
      }
      printDouble12(totalGross);
      printDouble12(totalTax);
      printDouble12(totalNet);
      System.out.println();
   }

   // (+) static void printAverages(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, int empNum, char
type)
   public static void printAverages(double totalRate, double totalQuantity, double totalGross, double totalTax, double totalNet, int empNum, char
type)
   {
      printString38("Averages: ");
      if (type != 's')
      {
         printDouble12(totalRate/empNum);
         printDouble12(totalQuantity/empNum);
      }
      else
      {
         printString12("");
         printString12("");
      }
      printDouble12(totalGross/empNum);
      printDouble12(totalTax/empNum);
      printDouble12(totalNet/empNum);
      System.out.println();
   }


   // (+) static void printFooter(GenericContainer myEmps)
   public static void printFooter(GenericContainer myEmps)
   {
      double totalGrossPay = 0;
      double totalTaxAmt = 0;
      double totalNetPay = 0;

      while(myEmps.Iterator_hasNext())
      {
         EmployeeRecord tempRecord = new EmployeeRecord(((Employee)myEmps.Iterator_getNext()).get());
         totalGrossPay += tempRecord.grossPay;
         totalTaxAmt += tempRecord.taxAmt;
         totalNetPay += tempRecord.netPay;
      }

      printString38("Grand Totals:");
      printString12("");
      printString12("");
      printDouble12(totalGrossPay);
      printDouble12(totalTaxAmt);
      printDouble12(totalNetPay);
      System.out.println();

      printString38("Grand Averages:");
      printString12("");
      printString12("");
      printDouble12(totalGrossPay/myEmps.getLength());
      printDouble12(totalTaxAmt/myEmps.getLength());
      printDouble12(totalNetPay/myEmps.getLength());
      System.out.println();
   }

   // (+) static void printString38(String str)
   public static void printString38(String str)
   {
      System.out.printf("%-38s", str);
   }

   // (+) static void printString12(String str)
   public static void printString12(String str)
   {
      System.out.printf("%12s", str);
   }

   // (+) static void printDouble12(double value)
   public static void printDouble12(double value)
   {
      System.out.printf("%12.2f", value);
   }

   // (+) static String concatenateName(String lastName, String firstName)
   public static String concatenateName(String lastName, String firstName)
   {
      return lastName + ", " + firstName;
   }
}
```

Pre-defined Datatype Screenshot



```
 ----jGRASP exec: java -ea Main
    Sorted Integer Collection
    -30     13     45     70    100

    Sorted string Collection
    Adams  Baker  Camille  Dixon  Johnson  Lee

 ----jGRASP: operation complete.
```

Programmer-defined Datatype Screenshot



```
==================================================================================================
                                  YOUR FINANCIAL REPORT ANALYSIS
==================================================================================================

Employee (Hourly)                                 Pay       Hours       Gross         Tax         Net
Name                                             Rate      Worked         Pay      Amount         Pay
=======                                         =====       =====       =====       =====       =====
Davidson, Carl                                  17.00       46.50      845.75      126.86      718.89
Doe, John                                        8.75       38.00      332.50       49.88      282.63

Totals:                                         25.75       84.50     1178.25      176.74     1001.51
Averages:                                       12.88       42.25      589.13       88.37      500.76

Employee (Salary)                                                      Salary         Tax         Net
Name                                                                      Pay      Amount         Pay
==============================================================          =====       =====       =====
Prentiss, Paula                                                        795.38      119.31      676.07

Totals:                                                                795.38      119.31      676.07
Averages:                                                              795.38      119.31      676.07

Employee (PieceWork)                           Pieces    Price of       Gross         Tax         Net
Name                                             Sold       Piece         Pay      Amount         Pay
=======                                         =====       =====       =====       =====       =====
Marion, Louise                                  40.00       13.00      520.00       78.00      442.00
Whittle, Ed                                     25.00       11.00      275.00       41.25      233.75

Totals:                                         65.00       24.00      795.00      119.25      675.75
Averages:                                       32.50       12.00      397.50       59.63      337.88

Grand Totals:                                                         2768.63      415.29     2353.34
Grand Averages:                                                        553.73       83.06      470.67

 ----jGRASP: operation complete.
```