EGR115
Algorithm Development Exercises

1. Suppose you have a set 10 of boxes on a table. Eight of the boxes are empty, but in one of the boxes is a **peach** and in another box is an **apple**. You would like to swap the peach and the apple – have the apple be where the peach is currently and have the peach end up being where the apple is currently. Unfortunately, you've broken one arm and cannot hold both of them concurrently. To avoid contamination, the fruit should never be placed anywhere other than a box. Provide a written ENGLISH description of the process for swapping the contents of the two boxes.

For the rest of the exercises, assume that you can only move one item at a time and that each box may contain a maximum one piece of fruit.

2. Provide a symbolic description that follows the written description from #1. Assume that at the beginning of the exercise the apple is in box 5 and the peach is in box 8. All other boxes are empty.

Use arrows (→) to indicate the action of placing into a box; and indicate a box or contents of a box by its number.

For example, taking the contents from box 3 and moving those contents to box 4 would look like this: 3 → 4

Apple

Banana

Cherry

Durian

Emblic (Indian Gooseberry)

3. Suppose now that you have five fruits: apple, banana, cherry, durian, and emblic. You decide to give a name for each box that will hold a specific fruit – so you have boxes A, B, C, D, and E. Show the symbolic description of putting the fruit into its associated box – just use the name of the fruit to represent the fruit itself.

4. For this exercise, all of the labeled boxes begin by containing the corresponding fruit. You decide to designate another box as box X. Provide a symbolic description of an algorithm that when executed will guarantee that each of the original five boxes contains a fruit, but each <u>does NOT</u> contain the correct fruit associated with that box. Make the algorithm as simple as possible.

When writing algorithms, we often have to make decisions – these involve comparisons.

To describe the decision process symbolically, we need to describe what is being compared:
to describe *being the same as* use two equal signs (==);
to describe *not being the same as*, use bang equal (!=).

For example, if I want to describe the decision process for checking to see if box A contains an apple, I would write:

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A == apple
```

If I want to describe the decision process for checking to see if box A does *not* contain an apple, I would write:

```
A != apple
```

To perform an action based upon the comparison, use a colon (:). So if I want to place the contents of A into B *only if* A contains an apple, I would write:

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A == apple: A → B
```

I can perform multiple actions by separating them by commas:

```
A == apple: A → B, X → A
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I can *nest* decisions, also – this means to make another decision based upon a previous decision. For example, if I want to move the contents of B to X but only if both A and B do not contain an apple:

```
A != apple: B != apple: B → X
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5. Each of the labeled boxes, A-E, contains a fruit although it may or may not be the correct fruit. Write a symbolic algorithm which guarantees that each does NOT contain the correct fruit. Box X is empty to begin.

6. Suppose that somebody has come along executed your algorithm from #5, so all of the fruit is mixed up. Each of the five boxes (A, B, C, D, and E) contains a fruit, but it is not the correct fruit. Box X is empty. Provide a symbolic description that puts the fruits into the correct boxes. (HINT: This may be easier if you write out the English algorithm and then convert it to symbolic form)