EECS486 Object-Oriented Methodology

Homework 6

Assigned: 01AP03
Due: 08AP03, by 8:40am
Points Possible: 40 points

- Students will work individually to complete this homework.
- Diagrams must be drawn using Visio.

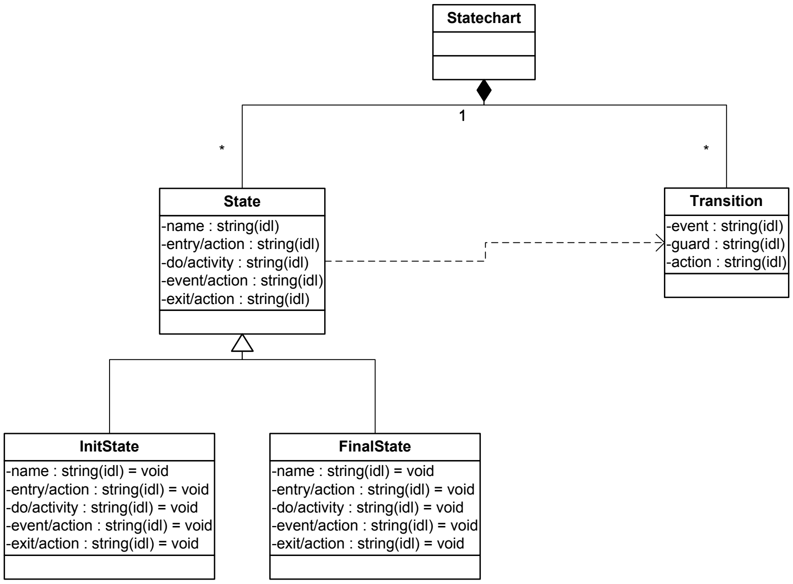
Homework Goals and Content

- Increased understanding of the interplay between all UML diagrams.
- Increased understanding of the following UML diagrams:
  - Activity diagram.
- Increased understanding of the following Object Modeling Technique (OMT) diagrams:
  - Dataflow diagram.
- Generation of study guide for the final exam.

Problem Description

Problem 1. UML Diagram Interplay (10 pts)

Throughout the semester we have discussed the Unified Modeling Language (UML). UML is known as a *meta-language*. That is, UML may be used to describe itself. As an example, the following UML Class diagram describes the contents of a Statechart diagram.

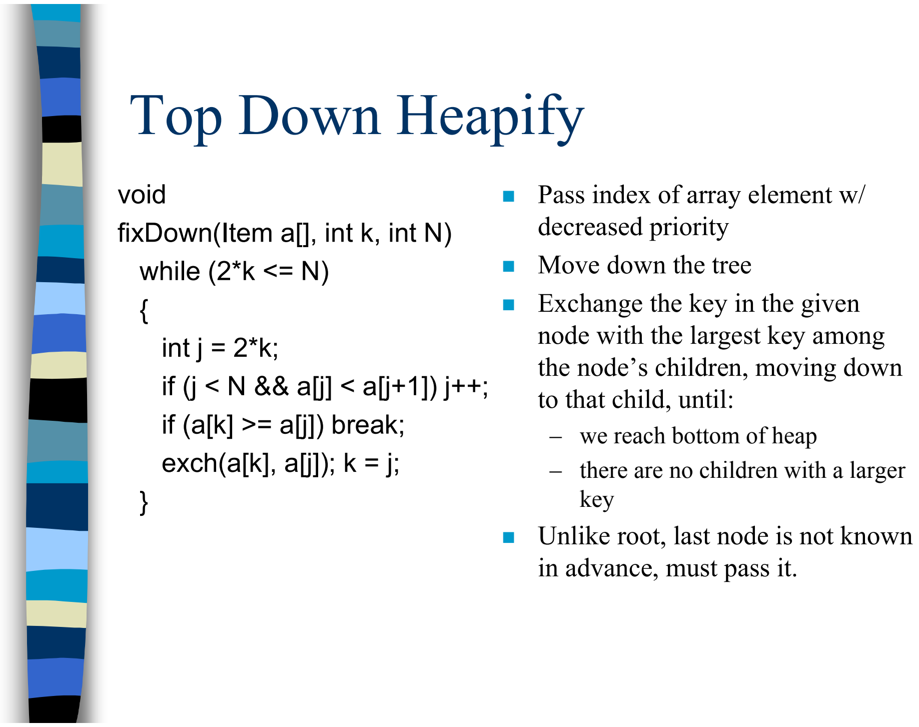


Statechart
1
*
*
State
-name : string(idl)
-entry/action : string(idl)
-do/activity : string(idl)
-event/action : string(idl)
-exit/action : string(idl)
Transition
-event : string(idl)
-guard : string(idl)
-action : string(idl)
InitState
-name : string(idl) = void
-entry/action : string(idl) = void
-do/activity : string(idl) = void
-event/action : string(idl) = void
-exit/action : string(idl) = void
FinalState
-name : string(idl) = void
-entry/action : string(idl) = void
-do/activity : string(idl) = void
-event/action : string(idl) = void
-exit/action : string(idl) = void

In a previous homework (Hwk5), students were asked to work in groups to determine the interdependence of various UML diagrams. The purpose of this homework problem is to draw a UML Class diagram that describes the entire UML family of diagrams. That is, draw UML as a Class diagram that describes the things, relationships, and dependencies between all UML diagram types.

Problem 2. Activity Diagram (10 pts)

Draw an Activity Diagram for the following C++ operation. The operation fixes a broken invariant in a heap. Specifically, the kth element is heapified in a heap a[ ] of size N. Note that it is not necessary to explicitly understand what the code does in order to draw the Activity Diagram. Do not include pre- or post-conditions.



Top Down Heapify

```
void
fixDown(Item a[], int k, int N)
  while (2*k <= N)
  {
    int j = 2*k;
    if (j < N && a[j] < a[j+1]) j++;
    if (a[k] >= a[j]) break;
    exch(a[k], a[j]); k = j;
  }
```

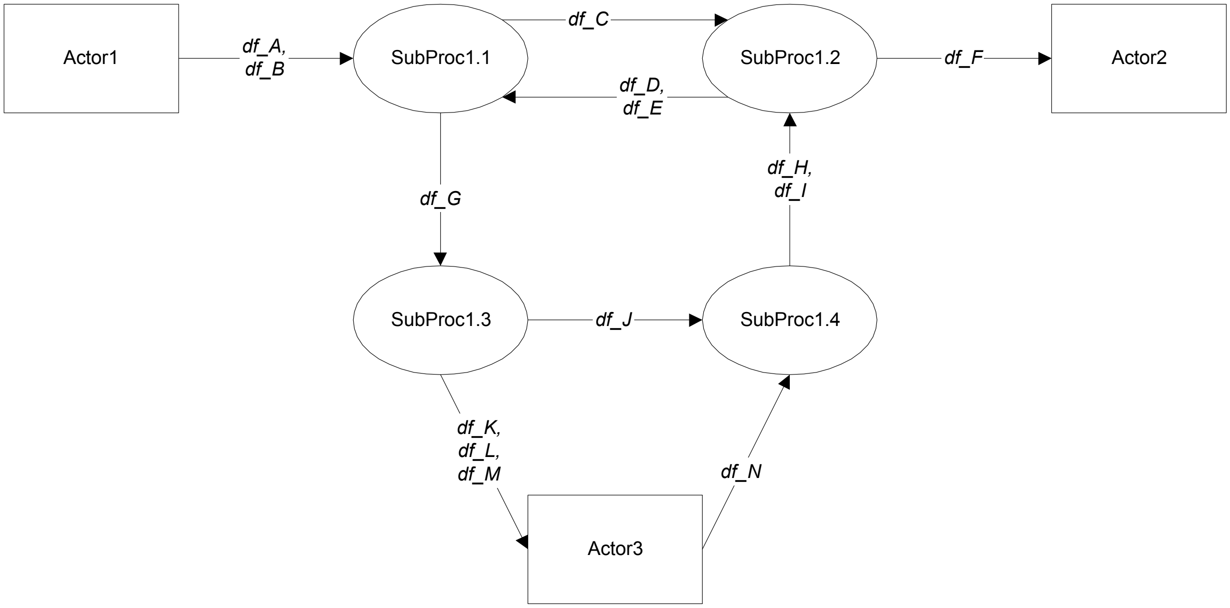
- Pass index of array element w/ decreased priority
- Move down the tree
- Exchange the key in the given node with the largest key among the node’s children, moving down to that child, until:
  - we reach bottom of heap
  - there are no children with a larger key
- Unlike root, last node is not known in advance, must pass it.

Problem 3. Dataflow Diagram (10 pts)

Part A) Given the following level 1 Dataflow Diagram, draw the corresponding level 0 Dataflow Diagram. Show all sources and sinks of data. Assume that there is a single process in the level 0 DFD.

Part B) Given the following level 1 Dataflow Diagram, and these additional constraints, draw the level 2 Dataflow Diagram for the SubProc1.2 process. Show all sources and sinks of data.

- SubProc1.2 has 3 ‘sub-subprocs’ named SubProc1.2.1, SubProc1.2.2, and SubProc1.2.3;
- SubProc1.2.1 is the input process, and thus consumes all input to SubProc1.2;
- SubProc1.2.3 is the output process, and thus produces all output from SubProc1.2;
- SubProc1.2.2 is the control process and consumes *df_Z* and *df_Y* produced by SubProc1.2.1;
- SubProc1.2.2 also produces *df_X* that is directly consumed by SubProc1.2.3, and produces *df_W* that is written to a datastore and eventually consumed by SubProc1.2.1.



Problem 4. Final Exam Study Guide (10 pts)

This problem is submitted individually, separately, and electronically. Formulate a question for the final exam. The question must have two properties: appropriate clarity and appropriate complexity. Clarity means that the description adequately describes the context for the problem. Complexity means that the problem reflects the correct level of difficulty for a senior level, four credit class at the University of Michigan. The set of all problems will be returned ungraded to the students as a study guide for the final exam. Up to three questions from the study guide may be included in the final exam. Submit to eecs486@umich.edu. The question should be in the form: student name, 2 blank lines, question. Please submit as ASCII characters embedded directly into your email submission. Diagrams, if necessary, may be submitted as attachments.