The University of Texas at Dallas
Department of Computer Science

Test 1 March 2, 2000

Conditions: Closed book Duration: 70 minutes

State assumptions, if there is any

Please write legibly; unreadable answers are NOT answers!

Name: ______________________________

{Please underline last name}

Student Number: ______________________________

1. __________ /20

2. __________ /20

3. __________ /40

4. __________ /20

Total __________ /100

1. [20 marks]

For each of the following ten statements, indicate whether it is true (mark T) or false (mark F). (No penalty for a wrong answer)

__T__ This is Test 1 for CS6362.

____ 1. The term "design pattern" is often used in place of the term "architecture", when referring to the structural view of a detailed design.

____ 2. No software architectural design is complete if it cannot absolutely and optimally satisfy the performance, reliability, safety and security requirements of the system.

____ 3. The quality of an object-oriented style of architectural design is often determined by the particular object-oriented programming language chosen to specify the design.

____ 4. A functional requirements specification and an architectural style together usually determine the particular architectural pattern for the target architecture.

____ 5. The number of components of a shared data style of software architecture can be determined in time proportional to the number of statements in the requirements specification.

____ 6. The behavior of a pipe-and-filter style of software architecture is correct if and only if the behavior of each of the individual filters is.

____ 7. Given n components, the total number of architectural alternatives is $O(e^n)$.

____ 8. Classical module interconnection languages (MILs) allow the software architect to precisely specify the behavior of each module in the software system.

____ 9. For most software architectures, time and space performance should be considered as being more important than other hard-to-measure system properties such as reusability and maintainability.

____ 10. One important benefit of those software architectures whose components communicate through explicit invocation is the high-degree of concurrency they offer.

2. [20 marks]

Consider the following declarations:

```
module M1
       provides: a;
       requires: v;
       string a, real v
end M1

module M2
       provides: b, c;
       requires: w, x;
       has-access-to: module M1
       consist-of: module M21, module M22

       module M21
              provides: b;
              requires: w;
              boolean b, integer w
       end M21

       module M22
              provides: c;
              requires: x;
              has-access-to: module M21
              integer c, real x
       end M22
end M2

module M3
       provides: v;
       requires: a;
       has-access-to: module M2
       real v, string a
end M3
```

2.1 List the set of variables that M1 can access.

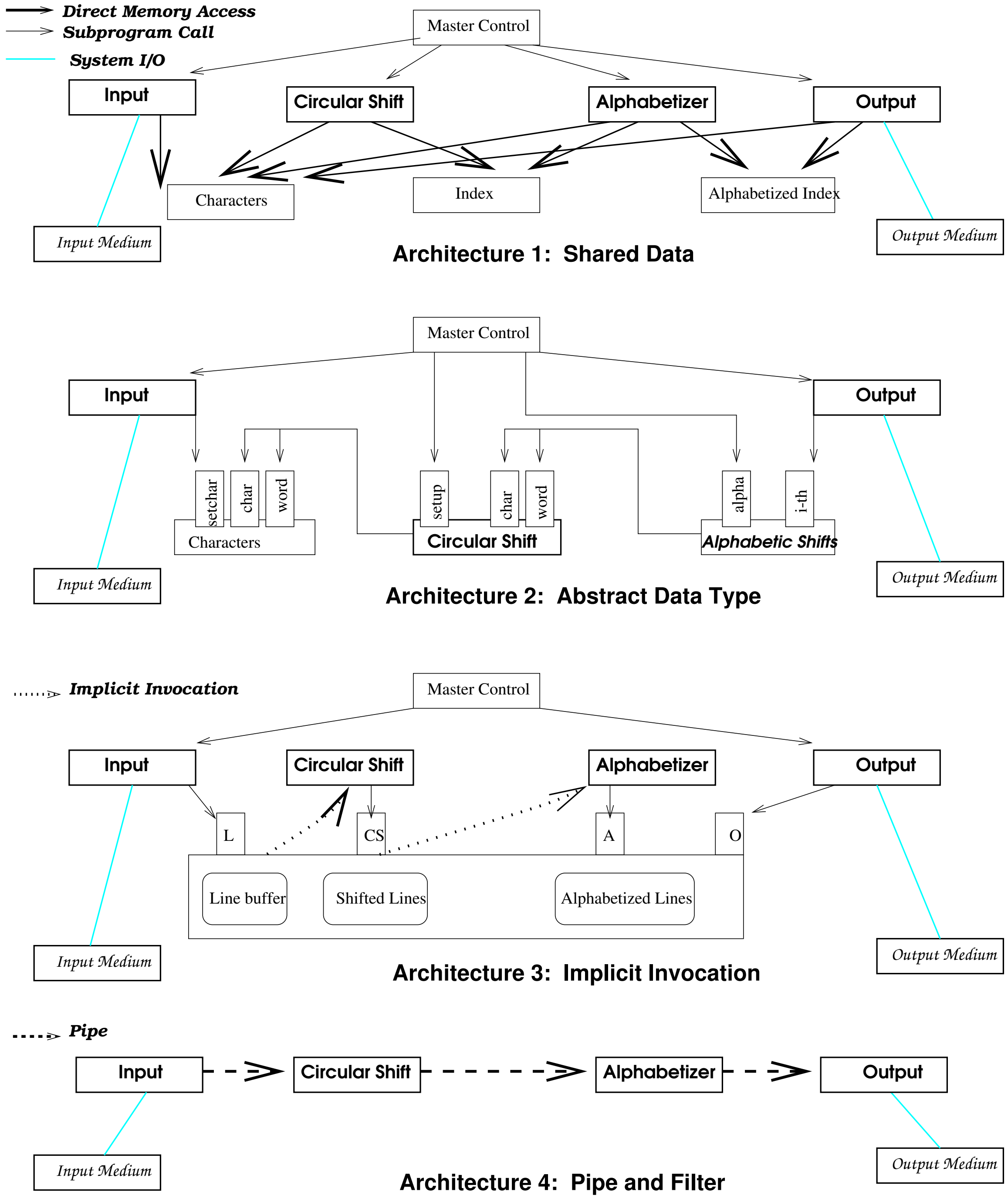
2.2 List the set of variables that M21 can access.

2.3 List the set of variables that M22 can access.

2.4 List the set of variables that M3 can access.

3. [40 marks]

Consider the following four architectures for the KWIC problem.



For the following questions, consider the following two titles read in as the input (separated by a $ sign):

architecting wireless collaboration$electronic business age$

3.1 Consider *Architecture 1.* As discussed in class, **Circular Shift** produces, for each line of circular shift, the starting index of the source line and the offset from the starting position.

Describe the indices for the second (2) and sixth (6) circular shifts.

3.2 Consider *Architecture 1.* As discussed in class, **Alphabetizer** converts "Index" to an "Alphabetized Index" by listing the circular shifts alphabetically.

Describe the indices for the second (2) and sixth (6) alphabetized circular shifts.

3.3 Consider *Architecture 2.* What would *char (2, 2, 2)* of **Characters** return?

3.4 Again consider *Architecture 2.* What would *char (2, 2, 2))* of **Circular Shift** return?

3.5 Consider *Architecture 3* Using a diagram, concisely and precisely describe where to add a new component to efficiently "omit" indices starting with a noise word (e.g., the, a, an, to, and, or, etc.) and what kind of changes are needed. More importantly, describe why you have chosen the particular place.

3.6 Consider *Architecture 3*. Suppose that the connection between the Master Control and Output modules is to be deleted from the architectural design. Using a diagram, precisely describe briefly What should be done to achieve the same functionality as before?

3.7 Describe concisely and precisely a first-cut approximation on the relative weaknesses and strengths of *Architecture 2* and *Architecture 3*.

3.8 Consider *Architecture 4*. In relation to the model of software architecture, as discussed in class, describe precisely and concisely why the figure alone is not adequate as the description of a software architecture.

Consider the following declaration of an ADT:

```
Airplane (P, A): trait /* P (e.g., ``Rose" and ``Jack") are elements of A */
      introduces
            new: -> A
            add: A, P -> A
            del: A, P -> A
            in: A, P -> Bool
      asserts
            A generated by new, add

            forall a: A, p: P, p': P

                  ~ in (new, p)

                  in (add(a, p), p')               if (p == p')
                  in (add(a, p), p') == in (a, p') otherwise

                  del (new, p) == new

                  del (add (a, p), p') == del (a, p)            if (p == p')
                  del (add (a, p), p') == add (del (a, p'), p) otherwise
      implies
            Cruiser (new for sail, add for on, del for off, in for danger)
```

Now, suppose you are using a theorem prover, called *TP*. Also suppose that "Rose" and "Jack" are members of P. For each of the following questions, show all your work (i.e., proofs).

4.1 What should TP return as the value of in (add (new, "Rose"), "Rose")?

4.2 What should TP return as the value of in (del (new, "Jack"), "Jack")?

4.3 What should TP return as the value of in (del (add (new, "Jack"), "Rose"), "Rose")?

4.4 What should TP return as the value of in (add (del (new, "Rose"), "Jack"), "Rose")?

4.5 What should TP return as the value of danger (on (off (sail, "Jack"), "Rose"), "Rose"), assuming that Cruiser has access to Airplane?