

ref. str.:	2	6	5	7	_	_	_	
	2	2	2	2				
		6	6	6				LRU
			5	5				
				7				
	2	2	2	2				
		6	6	6				FIFO
			5	5				
				7				

b) Continue the page reference string with at most 3 additional terms where FIFO will result in strictly fewer page faults than LRU.

3) Consider the Readers/Writers problem with a single writer. Any number of readers can examine a file and the writer is only allowed access when there are no active readers. Consider the following incorrect solution. The common variables and their initializations are given by:

```
semaphore wrt=1;
int readcount=0;
```

Code for the writer and the readers:

```
writer()
{
    wait(wrt);
    //Do the writing
    signal(wrt);
}

reader()
{
    if(readcount==0)wait(wrt);
    readcount++;
    //Do the Reading
    readcount--;
    if(readcount==0)signal(wrt);
}
```

Give an execution sequence where a reader and the writer have access at the same time.

CS 6901 Capstone Exam Data Structures and Algorithms Spring 2017

Choose any 2 of the 3 problems.

1) Given a possibly empty binary tree containing character data, write a function that returns the number of left children in the tree. The prototype for your function should be

```
int LeftCount(TreeNode *ptr) .
```

Global variables may not be used. Declare all data structures.

2) Given a possibly empty singly linked list, write a function that reverses the last 4 nodes of the list (without altering the earlier nodes). If the given list has fewer than 5 nodes, the entire list should be reversed. The prototype for your function should be

```
void Reverse4(Nodetype *ptr) .
```

3

# Theory Exam

---

Answer ANY TWO of the following three questions:

1. A certain programming language defines a comment as delimited by `/#` and `#!/`. Let the alphabet  $\Sigma = \{a, b, /, \#\}$  and let  $C$  be the set of all comments that begin with `#`, end with `#!/`, and contain no intervening `#!/`. The shortest legal string is therefore `###/`.

- a. (10 points) Give a deterministic finite automaton (DFA) that recognizes legal comments  $C$  in the language  $\Sigma$ .
- b. (10 points) Write a context-free grammar (CFG) that generates legal comments  $C$  in the language  $\Sigma$ .

2. Consider the language  $L = \{ \langle M \rangle \mid M \text{ is a Turing machine that accepts the string } w = 0011 \}$ .

- a. (5 points) Is  $L$  decidable or undecidable?
- b. (15 points) Prove your answer above using reducibility. You may use the fact that  $0 \leq T \leq 1$  for any Turing machine  $T$ .

c. Given a graph  $G$  and a number  $k$  is the largest clique in  $G$  of size  $k$

(a clique is a subgraph  $G'$  that is a complete graph)

d. Given a Boolean expression

codmngExpwof0.26T.0/Td2G)Tj4(27(16)3(a