ESOF 322 Software Engineering I
Homework #5 (32 points total)
Due: Tuesday November 5th
Hand in your printed copy in class, and submit a PDF file into D2L.

Question 1 (10 pts)

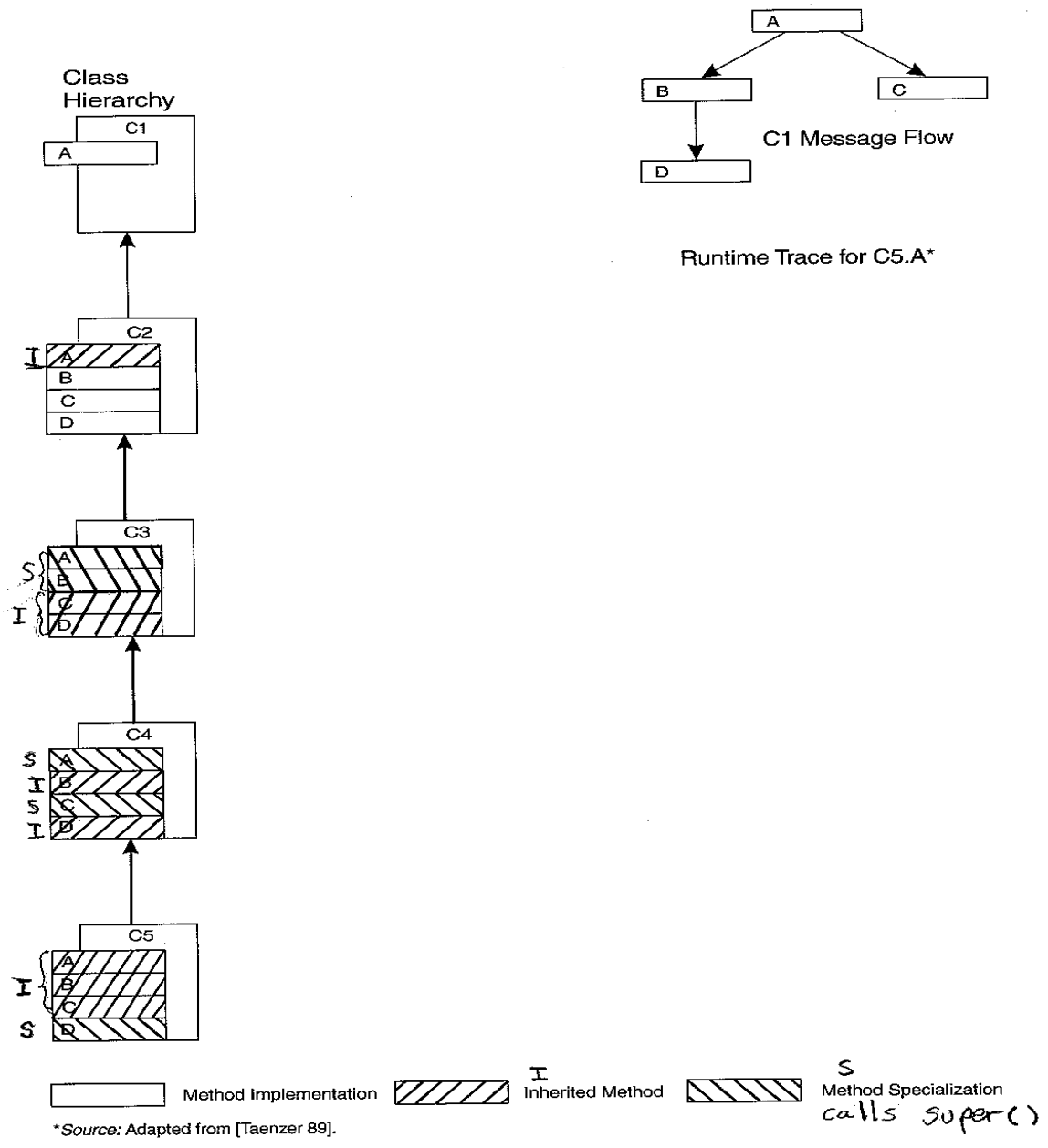
a) Create a control flowgraph for the *sieve* algorithm. To the left of the line numbers in the source code clearly identify the nodes that will be used in your graph. Once you have identified the nodes, draw the control graph. **(4 pts)**

```
1. /* Find all primes from 2-upper_bound using Sieve of Eratosthanes */
2.
3. #include
4. typedef struct IntList {
5.           int value;
6.           struct IntList *next;
7.           } *INTLIST, INTCELL;
8. INTLIST sieve ( int upper_bound ) {
9.
10.       INTLIST prime_list = NULL;   /* list of primes found */
11.       INTLIST cursor;              /* cursor into prime list */
12.       int candidate;               /* a candidate prime number */
13.       int is_prime;                /* flag: 1=prime, 0=not prime */
14.
15.        /* try all numbers up to upper_bound */
16.        for (candidate=2;
17.
18.             candidate <= upper_bound;
19.             candidate++) {
20.
21.         is_prime = 1; /* assume candidate is prime */
22.         for(cursor = prime_list;
23.
24.              cursor;
25.              cursor = cursor->next) {
26.
27.            if (candidate % cursor->value == 0) {
28.
29.              /* candidate divisible by prime */
30.              /* in list, can't be prime */
31.              is_prime = 0;
32.              break;  /* "for cursor" loop */
33.            }
34.         }
35.         if(is_prime) {
36.
37.           /* add candidate to front of list */
38.           cursor = (INTLIST) malloc(sizeof(INTCELL));
39.           cursor->value = candidate;
40.           cursor->next  = prime_list;
41.           prime_list = cursor;
42.         }
43.        }
44.        return prime_list;
45.       }
```

b) Provide a set of test cases that would give 100% Node Coverage (NC). **(2 pts)**
c) Provide a set of test cases that would give 100% Edge Coverage (EC). **(2 pts)**
d) Is 100% NC or 100% EC possible in general? Why, or why not? **(2 pts)**

Question 2 (10 pts)

a) Draw the execution of the calls that exhibit the YoYo problem for a runtime trace of C3.B, and for C4.A (Draw both on the diagram below). **(8 pts)**
b) Describe what happens when we call C1.D **(2 pts)**



Question 3 (12 pts)

Given the following program:

```
1: public int fibonacci (int i) {
2:     int fib1 = 1 ;     // fib(n-1)
3:     int fib2 = 1 ;     // fib(n-2)
4:     int fib = 0;
5:     int j;

6:     if (i <= 1)
7:         fib = 1;
       else
8:         for (j=1;
9:              j<i;
10:              j++)
            {
11           fib  = fib2 + fib1 ;
12           fib2 = fib1 ;
13           fib1 = fib ;
            }
14:    return fib ;
      }
```

Give test cases that will kill the following mutations **(4pts each)**:

(a) Line 6: if (i < 1)

(b) Line 6: if (i == 1)

(c) Line 12: fib2 = fib;