

**COMP 2404**  
**Midterm Exam**

$\frac{88.35}{50} \Rightarrow 1.767 \approx 70\%$

[out of 50 marks]

Duration: 80 minutes

Authorized Memoranda: NONE

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**Multiple Choice Questions (circle ONE answer for each question)**

**[10 marks]**

1. Given the program in Figure 1, which of lines (24) to (26) are valid and will not result in an error:  
a. (24)  
☒ b. (25)  
c. (26)  
☒ d. (24) and (25) 2
2. Given the program in Figure 1, which of lines (28) to (30) are valid and will not result in an error:  
☒ a. (28) and (29)  
b. (28)  
c. (30)  
d. (29) X
3. Given the program in Figure 1, which of lines (32) to (34) are valid and will not result in an error:  
a. (32)  
b. (33)  
c. (34)  
☒ d. (32) and (34) X 2
4. Given the program in Figure 1, which of lines (36) to (38) are valid and will not result in an error:  
a. (36) and (37)  
☒ b. (37)  
c. (38)  
d. none X
5. Given the program in Figure 1, which of lines (40) to (42) are valid and will not result in an error:  
a. (40) and (41)  
b. (41)  
☒ c. (42)  
d. none X

```

01 class Z {
02     public:      void op1(string s) { s = "xyz"; }
03     protected: int z1;
04     private:    Y y1; };
05
06 class X {
07     public:      void op1(int& i) { i = 99; }
08                 bool op2(int& n) { if (n > 0) return true; else return false; }
09                 int x2;
10                 Z z1;
11     protected: int x1;
12     private:   int x3; };
13
14 class Y : public X {
15     public:
16         bool op2(int k, char& c) { if (k < 10 && c > 0) c = 'J'; return true; }
17     protected: int y1;
18     private:   int y2; };
19
20 int main() {
21     X x; Y y; Z z;
22     string tmp = "hello"; int n1 = 12; int n2 = 34; char c = 'C';
23
24     y.op2(n1); X
25     y.op2(n1, c); ✓
26     x.op2(n1, c); X
27
28     y.x1 = 0; ✓
29     y.x2 = 0; ✓
30     x.y1 = 0; X
31
32     x.z1.op1(tmp); ✓
33     z.x1.op2(n1); ✓
34     z.y1.op2(n1, c); ✓
35
36     z.y1.op2(n2); X
37     z.y1.op2(n2, c); ✓
38     y.z1.op1(tmp); X
39
40     y.z1.z1 = 0; X
41     y.z1.op1(tmp); ✓
42     z.y1.y1 = 0; ✓
43
44     return 0;
45 }

```

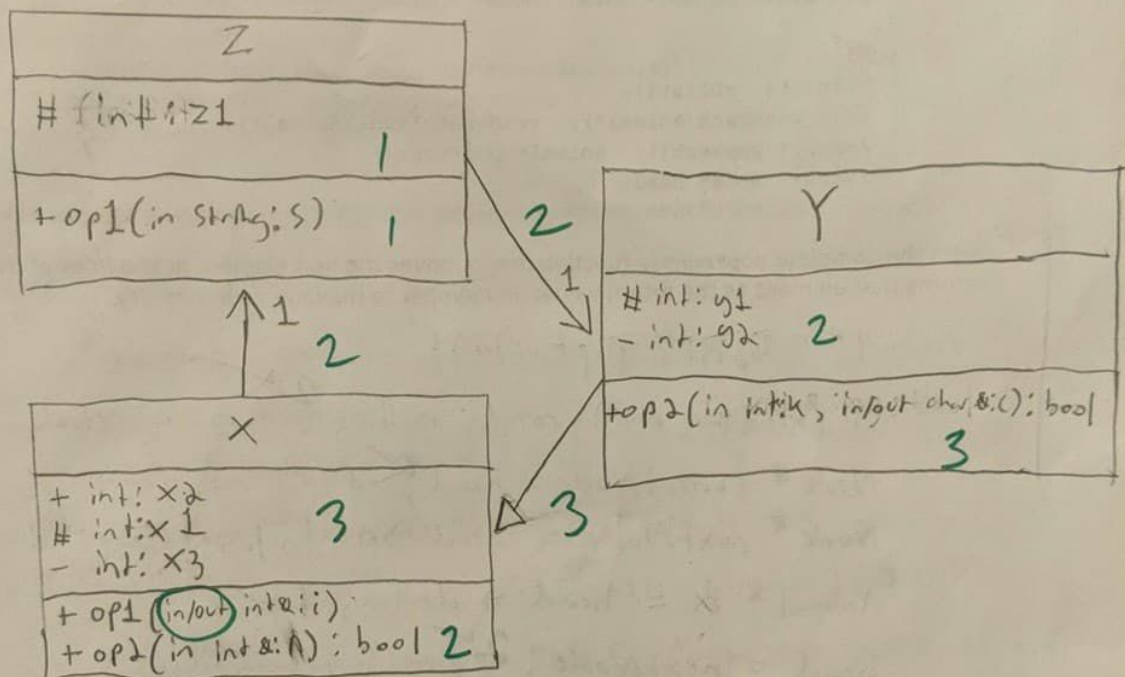
no x1 in Z

Figure 1

ML Question

[20 marks]

6. Draw the UML diagram corresponding to the classes defined in Figure 1. You must show all classes, and all attributes, operations, associations, directionality, and multiplicity, where applicable:



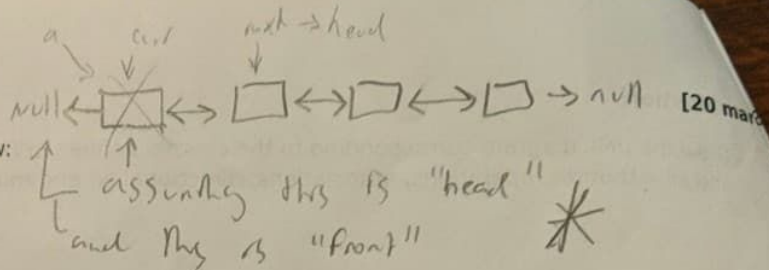
(19)



## Programming Questions

7. Given the class definition below:

```
class Dlist {
    class Node {
        friend Dlist;
        private: Animal* data; Node* prev; Node* next;
    };
public:
    Dlist(); ~Dlist();
    void pushBack(Animal*); void pushFront(Animal*);
    Animal* popBack(); Animal* popFront();
private: Node* head;
};
```



write the complete `popFront()` function that removes the first element at the front of the list and returns that element as the return value. Remember to manage your memory.

[10 marks]

`Animal* Dlist::popFront()`

`if (head == null) { return null; }` // basic err check

`Node* currentNode = head;` // start at front

`Node* nextNode = head->next;` // nextNode->prev = null;

`Animal* a = head->data;` // disconnect head

`head = nextNode;` // point to new head

`delete currentNode;` // current still holds original head

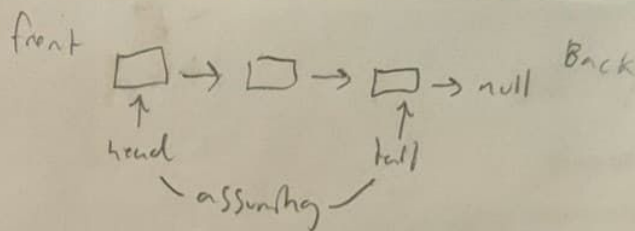
`return a;`

}

10

Given the class definition below:

```
class Tlist {
    class Node {
        friend Tlist;
        private: Animal* data; Node* next;
    };
    public:
        Tlist(); ~Tlist();
        void pushBack(Animal*); void pushFront(Animal*);
        Animal* popBack(); Animal* popFront();
    private: Node* head; Node* tail;
};
```



write the complete pushBack() function that adds the given element to the back of the list.

[10 marks]

```
void Tlist::pushBack(Animal* a){
    // Node* current Node = tail; ← don't need
    Node* addNode;
    addNode → data = a; } declare new node
    tail → next = addNode; // add to end
    tail = addNode; // tail points to new end
    addNode → next = null; // new end points to null
}
```

(4)