

CSC4001 Software Engineering

Assignment 1

Due – 23:59, 1st March, 2024

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Note: Late submission will have grade of 0

1.1 Single Choice (10 points) Each question has only *one* correct answer.

(a) (5 points) Which of the following statement is correct?

- A. Integration testing focuses on determining if the system meets the requirements.
- B. System testing focuses on validating if the subsystems work well with each other.
- C. Acceptance testing is performed by the developer and client.
- D. Alpha test is conducted at developer's site.

(b) (5 points) Which of the following statement is correct?

- A. Functional testing aims to cover all requirements.
- B. Structural testing is not suitable for unit testing.
- C. Random testing aims to cover all the code.
- D. Functional testing is white-box.

1.2 Multiple choice (10 points) Each question has multiple correct answers.

(c) (5 points) Which of the following statements are correct?

- A. It is feasible to go through all possible inputs for a trivial program.
- B. Design knowledge is required when determining test cases for structural testing.
- C. The test data for functional testing is selected uniformly.
- D. Random testing is black-box.

(d) (5 points) Which of the following statements are correct?

- A. Dividing inputs into equivalence classes aims at finding some classes with higher failure density.
- B. The number of test cases in pairwise combinatorial testing only depends on the number of parameters.
- C. Pairwise combinatorial testing helps reducing the number of test cases.
- D. Pairwise combinatorial testing can be generalized to k-tuples.

2. Coverage (40 points)

Consider the following python program:

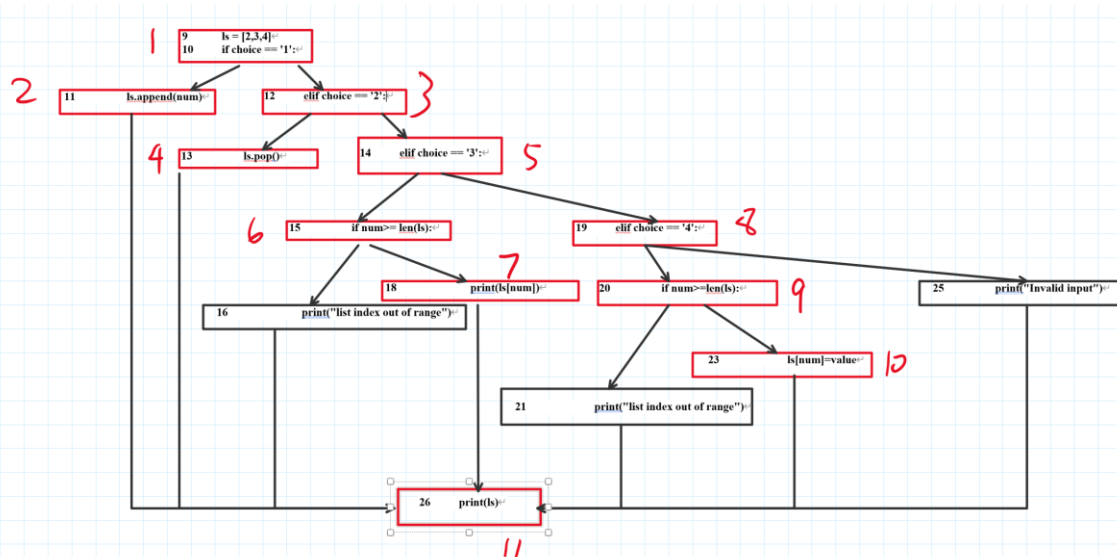
```
1 def list_operations(choice, num=0, value=0):
2     """
3     # Select an operation
4     # choice 1. Append
5     # choice 2. Pop
6     # choice 3. Query
7     # choice 4. Modify
8     """
9     ls = [2,3,4]
10    if choice == '1':
11        ls.append(num)
12    elif choice == '2':
13        ls.pop()
14    elif choice == '3':
15        if num >= len(ls):
16            print("list index out of range")
17        else:
18            print(ls[num])
19    elif choice == '4':
20        if num >= len(ls):
21            print("list index out of range")
22        else:
23            ls[num]=value
24    else:
25        print("Invalid input")
26    print(ls)
```

(a) (20 points) For the given test suite

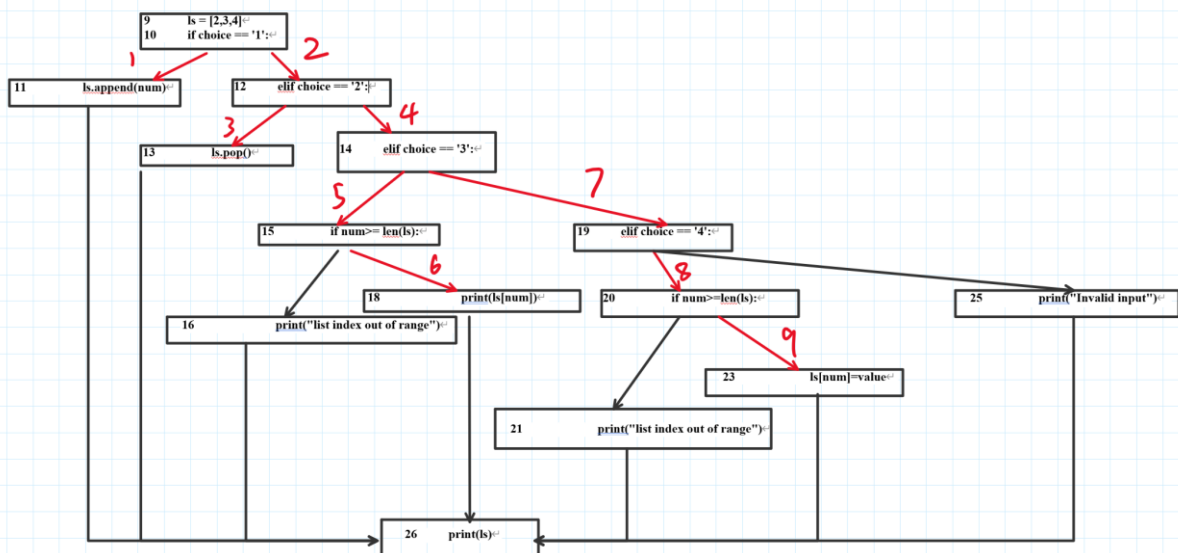
```
{choice='1', num=1};
{choice='2'};
{choice='3', num=2};
{choice='4', num=2, value=8},
```

please calculate the statement coverage and branch coverage. For the statement coverage calculation, please count the number of nodes instead of statements. Please provide your calculation details (e.g., the cfg and the formula you use).

Solution:



Statement Coverage: 11/14



Branch Coverage: 9/12

(b) (10 points) Please provide a test suite that contains at most 7 test cases and achieves 100% statement coverage.

Solution:

An example test set:

```

{choice='1', num=1};
{choice='2'};
{choice='3', num=2};
{choice='3', num=3};
{choice='4', num=2, value=8};
{choice='4', num=3, value=8};
{choice='5'}.
  
```

(c) (10 points) Please provide a test suite that contains at most 7 test cases and achieves 100% branch coverage.

Solution:

An example test set:

```
{choice='1', num=1};  
{choice='2'};  
{choice='3', num=2};  
{choice='3', num=3};  
{choice='4', num=2, value=8};  
{choice='4', num=3, value=8};  
{choice='5' }.
```

3. Control Flow Analysis (40 points)

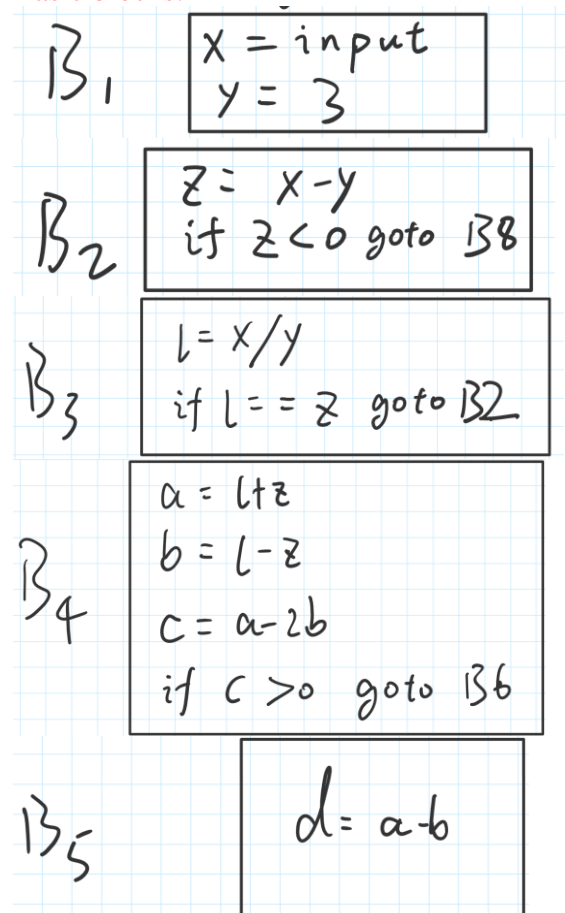
```
1  x = input
2  y = 3
3  z = x - y
4  if z < 0 goto (14)
5  l = x / y
6  if l == z goto (3)
7  a = l + z
8  b = l - z
9  c = a - 2b
10 if c > 0 goto (12)
11 d = a - b
12 if c / d != 0 goto (14)
13 e = 6
14 return
```

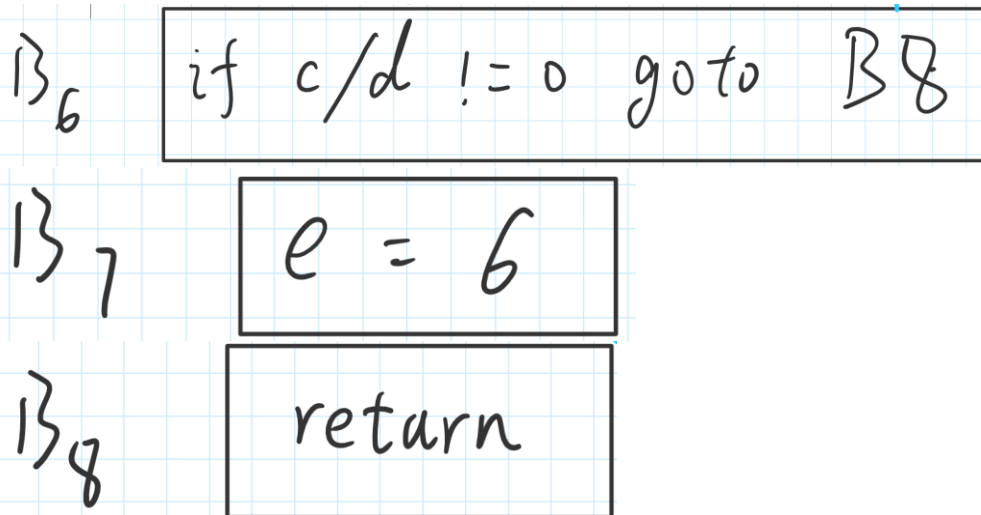
(a) (20 points) Given the 3-address code (3AC), please identify the leaders and the basic blocks.

Solution:

Leaders: 1, 3, 5, 7, 11, 12, 13, 14

Basic blocks:





(b) (20 points) Based on the basic blocks you identified, please construct the control flow graph.

Solution:

