Concordia ID: _____   **Name:** _____

Exercise 1

Create the control flow graph for the method shown in the figure below. Based on the graph, <u>compute the McCabe complexity</u> metric and <u>list all possible execution paths</u>. Note the presence of the logical **AND operator** (&&) in **statement 6**.

```java
public void processPacket(Packet document) {
1       String author = "Unknown";
2       String title = "Untitled";
3       int startPos = 0, endPos = 0;

4       if (document.message_.startsWith("!PS")) {
5          startPos = document.message_.indexOf("author:");
6          if (startPos >= 0 && startPos < document.message_.length()) {
7              endPos = document.message_.indexOf(".", startPos + 7);
8              author = document.message_.substring(startPos + 7, endPos);
           }
9          startPos = document.message_.indexOf("title:");
10         endPos = document.message_.indexOf(".", startPos + 6);
11         title = document.message_.substring(startPos + 6, endPos);
       } else {
12         title = "ASCII DOCUMENT";
13         if (document.message_.length() >= 16) {
14             author = document.message_.substring(8, 16);
           }
       }

15      List<Node> path = new ArrayList<Node>();
16      Node currentNode = firstNode_;
17      while (! document.destination_.equals(currentNode.name_)) {
18         path.add(currentNode);
19         currentNode = currentNode.nextNode_;
       }

20      System.out.println(author);
21      System.out.println(title);
22      System.out.println(path);
}
```

Exercise 2
Which of the following slice profiles corresponds to the code of Exercise 1?

Compute the slice-based cohesion metrics Overlap, Tightness and Coverage by considering as output variables: a) $V_O = \{\texttt{author}, \texttt{title}, \texttt{path}\}$ and b) $V_O = \{\texttt{author}, \texttt{title}\}$

Would you decide to decompose method `processPacket` based on the slice profile and the computed metric values? If yes, how exactly would you decompose the method? Does the decomposition cause any code duplication?

A

id	author	title	path
1			
2			
3	|	|	
4	|	|	
5	|	|	
6		|	
7		|	
8			
9	|	|	
10		|	
11	|	|	
12			
13			
14			
15			|
16			|
17			|
18			|
19			|
20			
21			
22			|

B

id	author	title	path
1	|		
2		|	
3	|	|	
4	|	|	
5	|		
6	|		
7	|		
8	|		
9		|	
10		|	
11		|	
12		|	
13	|		
14	|		
15			|
16			|
17			|
18			|
19			|
20	|		
21		|	
22			|

C

| id	path	author	title
1	|		
2	|		
3	|		
4	|		
5	|		
6		|	
7			|
8		|	|
9		|	|
10	|		
11	|		
12	|		
13	|		
14			|
15			|
16			|
17			|
18		|	
19		|	
20		|	
21			|
22	|		

Exercise 3

Let's assume that you are the maintainer of the class represented below as a graph (squares correspond to methods, circles correspond to attributes, edges correspond to attribute accesses or method calls).
Compute the following class-level cohesion metrics:

- LCOM (Chidamber and Kemerer)
- LCOM (Li and Henry)
- LCOM (Hitz and Montazeri)
- LCOM (Henderson-Sellers)
- Cohesion (Briand et al.)
- Tight Class Cohesion (Bieman and Kang)
- Class Cohesion (Bonja & Kidanmariam)

Would you decide to decompose this class into more classes? If yes, how would you decompose it? Which metrics represent better your decision? Compute the metric values for the classes resulting after the decomposition (only for the metric(s) that you selected in the previous question).
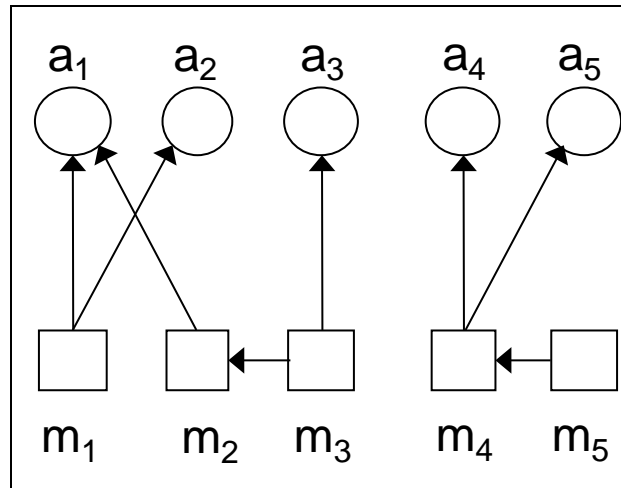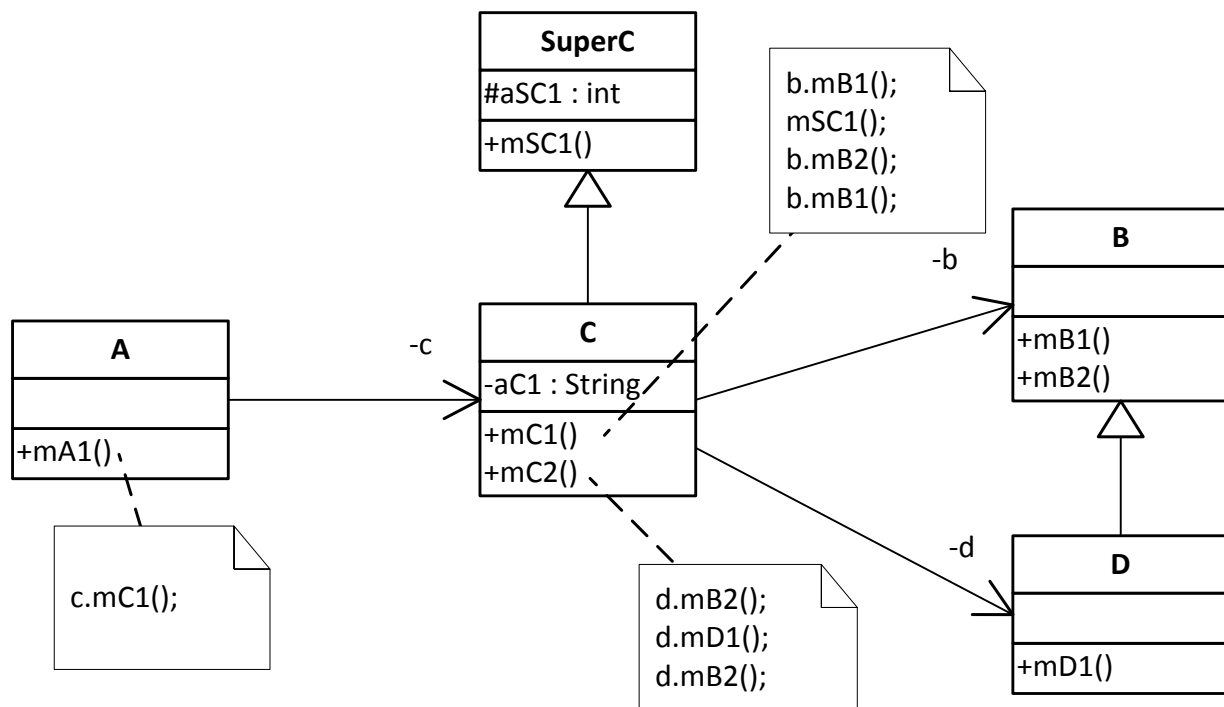
Exercise 4

Let's assume that you are the maintainer of the sub-system shown in the UML Class diagram below. Compute the following coupling metrics **for class C**:

- Coupling Between Objects (Chidamber and Kemerer)
- Response For Class (Chidamber and Kemerer)
- Message Passing Coupling (Li and Henry)

Compute the following coupling metrics **at system level**:

- Coupling Factor (F. Brito e Abreu)
- Coupling Factor (Briand et al. definition, **excluding** client-server relationships due to inheritance)

Are there any design changes that could be performed in order to reduce the coupling of class C? If yes, provide an updated UML Class diagram. Which of the aforementioned metrics are affected in the new design?

Evaluation Criteria for Midterm Test (10 points)

Task	Points
Exercise 1	3
Exercise 2	2
Exercise 3	3
Exercise 4	2

Test duration: 2½ hours
Good luck!