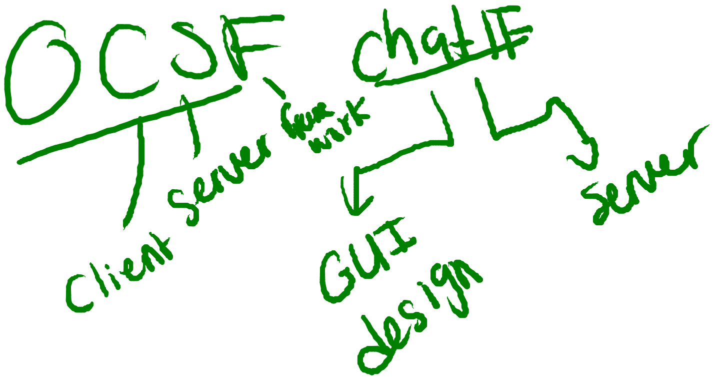
n=clients *Server n+1 threads

*Client 2xn threads



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Faculté de génie

École d'ingénierie et de
technologie de l'information

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Canada's university

University of Ottawa
Faculty of Engineering

School of Information
Technology and Engineering

SEG2105 - Introduction to Software Engineering
Midterm Examination

Professor(s): Wassim El Ahmar

October 2022, duration: 80 minutes

Identification

Student name: ______________________________

Student number:______________________________Section: Ⓐ Ⓑ Ⓒ Signature:______________________

Instructions

1. A double-sided cheat-sheet **(8.5"x11")** is allowed;
2. No calculators, electronic devices or other aids are permitted;
3. Any electronic device or tool must be shut off, stored and out of reach;
4. If you don't understand a question, state an assumption;
5. Write your answers in the space provided.
6. You may not hand in additional pages;
7. You can remove the last page of this examination;
8. Beware, poor hand writing can affect grades;

Marking scheme

Question	Maximum	Result
1-18	36	
19	8	
20	28	
Total	72	

Part 1 - Multiple Choice Questions (36 marks)

For the multiple choice questions, circle the single best answer. There is only one best answer for each multiple choice question. Questions 1-18 are by default worth 2 marks each (total of 36 marks).

1. An email client such as Thunderbird, where users can access and send emails and consult a calendar in their preferred OS (Thunderbird is cross-platform), is a______client application.

Thin — Server
Fat — Client

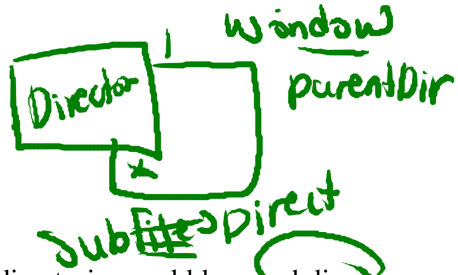
a) Thin

[✓ b) Fat]

c) Horizontal

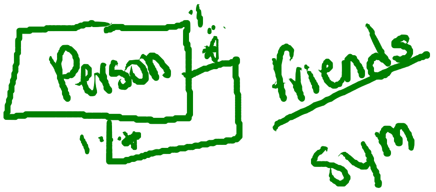
d) Peer-to-Peer

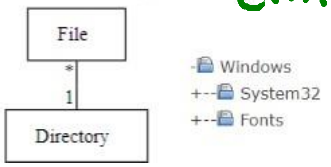
e) Multi-threaded

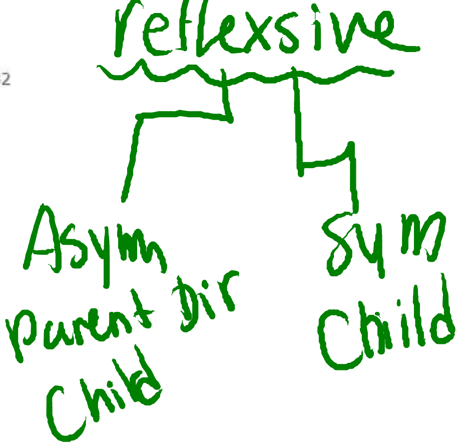


2. What should be added to the diagram below to represent the fact that parent directories could have subdirectories? For instance, Windows is the parent directory of System32 and Fonts, which may contain other files or (sub-directories).

Children







a) An association class.

[✓ b) A reflexive association (in class Directory)]

c) An attribute 'subdirectory' in class Directory.

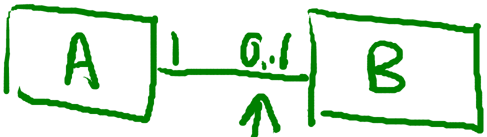
d) Multiple subclasses for class Directory

e) None of the above

3. Which of the following associations can generate the code in the figures below?

```
public class A
{
        private B b;
        public A(){}
        //More Code omitted
}

public class B
{
        private A a;
        public B(A aA)
        {
                boolean didAddA = setA(aA);
                if (!didAddA)
                {
                        throw new Exception("Unable to create instance");
                }
        }
        //More Code omitted
}
```



- public B requires A to instantiate ↗

for B to exist it requires 1 A

a) A 0..1 – * B

b) A 1 – 0..1 B

c) A 1 – * B - private B exists b;

d) A 1 – 1 B

e) None of the above

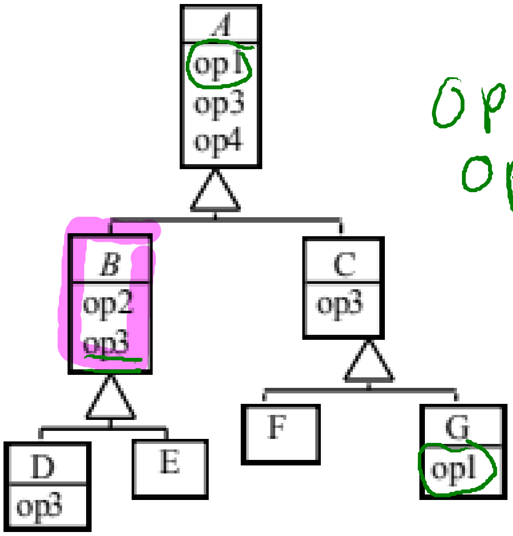
4. If a variable is declared of "type B", for the call of which operation(s) will dynamic binding always be needed?

dynamic binding

↳ Super? / leaf? No

yes ↙ Does the method exist > 1 times Yes

Yes / Only 1 method No



Op2 ✓

DB: Op3

Op3? Yes

↑

↳ overridden method in 1 of the subclasses

a) op1

b) op2

[✓ c) op3]

d) op2 and op3

e) None of the above: Dynamic binding is not needed.

5. Which aspect of quality would be most improved by the decision to create a framework when developing a software system?

   a) Usability

   b) Efficiency

   c) Reliability

   d) Maintainability

   [✓ e) Reusability]

frameworks => Reusability

mandatory to mend framework to product -> Slots & hooks -> optional

↑ Reusability

Not taught

6. Which type of UML models contains elements that might not be in the domain, but are needed to build a complete system?

   a) Exploratory Domain Model

   b) System Domain Model

   [✓ c) System Model]

   d) Use Case Diagram X Never heard of in class

   [✓ e) Instance Diagram]

7. A Java class that has an abstract method:

   [✓ a) Must be declared abstract]

   b) Must contain other abstract methods f

   c) Must be declared as an interface f

   d) Can't have any concrete method definitions f

   e) None of the above

Abstract methods in abstract class ONLY

8. Which of the following are not part of a UML Class Diagrams:

   a) Classes ✓

   b) Associations ✓

   ity c) Operations

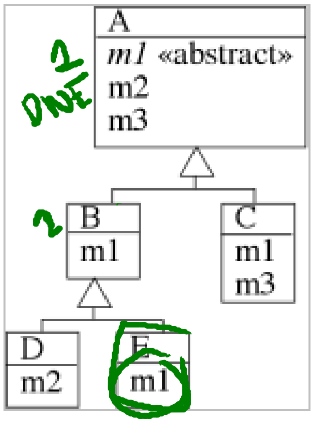
   d) Attributes ✓

   [✓ e) Encapsulations]

private? protected?

→ cheat sheet ↳ UML supposed to be vague

9. In the diagram below, which method would run if you had a variable of type A containing an object of class E (i.e. A a = new E()), and the operation m1 was called on this variable?



Aa = new E()

m1

   a) The m1 in class A

   b) The m1 in class B

   c) The m1 in class C

   [✓ d) The m1 in class E]

   e) There would be an error as the m1 in class A is abstract

10. Which of the following is false about access level modifiers?

   a) If a class has no modifier, it is visible only within its own package T

Defaut package.

   [✓ b) The private modifier specifies that the member can only be accessed in its own class or from a child class.]

F Only own class → protected

   c) The protected modifier specifies that the member can only be accessed within its own package. T

   d) Developers should use the most restrictive access level that makes sense for a particular member. Use private unless you have a good reason not to. T

   e) Public fields should be avoided except for constants. T

protected - class + child

Private - class members Not child

public - everybody

package - anything w/w package

11. Which of the following is false about interfaces in Java?

a) An interface in the Java programming language is an abstract type that is used to specify a behavior that classes must implement.

b) A class in Java can implement mutiple interfaces. ✓

c) Interfaces in Java (any JDK version) can be instantiated. ✓ abstract ↳ cannot be instantiated

d) It is possible to have concrete function definitions in a Java interface. ✗

e) None of the above

12. Which of the following statements is true about instance variables?

[✓ a)] Instance variables across different objects may have different values ✓

Instance vs Class var?

b) Its value is shared by all instances of a class.

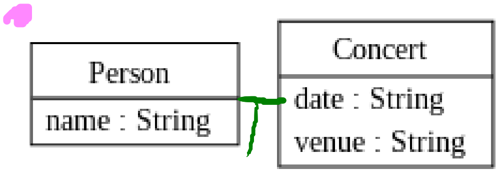
c) They are sometimes used for constant values. runtimes Not shared shared static

d) If changes are made to an instance variable, all other instances will see the effect of the changes.

e) None of the above

Want: Messi Ronaldo // different values

Refer to the following diagram for questions 13 and 14



✓✗ 0..1 1..*

13. What should the multiplicities between the classes Person and Concert be? A Concert must have at least one spectator (person), and a person can attend many Concerts.

a) 0..1 to 0..1

b) 0..* to 1

c) 0..* to 0..*

d) 0..* to 1..*

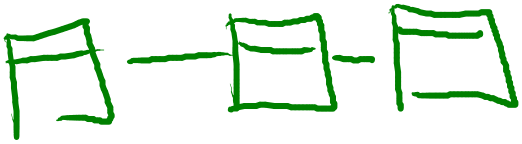
[✓ e) 1..* to 0..*]

person
*
1..*
concert

14. If I wanted to add the ability to sell tickets to a Person in order to attend a concert, what would be the best way to do it? We want also to record the ticket number and price paid.

a) ✗ Add attributes ticketNumber and unitPrice to the Person Class.

b) ✗ Add attributes ticketNumber and unitPrice to the Concert Class.



c) Create a class Ticket with attributes ticketNumber and unitPrice and associate it with class Concert in a many-to-one association. ✗

[✓ d)] Create an association class Ticket with attributes ticketNumber and unitPrice.

e) Create a class Ticket with attributes ticketNumber and unitPrice and associate it with class Person in a many-to-many association. ✗

record info between 2 classes ⟹ association class

15. Consider the following code snippet. Which of the following statements is false? * mentioned during class

```
try {

} catch (ArrayIndexOutOfBoundsException e) {

} catch (ArithmeticException e) {

} catch (Exception e) {

}
```

- Can be reached

checked exceptions

a) This third handler catches exceptions of type Exception; therefore, it catches any exception except ArrayIndexOutOfBounds Exceptions and Arithmetic exceptions.

b) This code will compile. T

[✓ c) The second handler could never be reached.] F

d) None of the above

16. Which of the following statements is false?

Code should be readable

a) Adding comments to the code helps make it more readable. ✓

b) Adding comments to the code helps make it more maintainable. ✓

Dont comment

[✓ c)] Adding comments is always a good practice, even if it was commenting obvious/trivial operations. ✓

d) None of the above

Not In Exam

chapter 6?

17. Which of the following statements about requirements gathering is false?

a) Requirements analysis aims at writing un-ambiguous, objective statements describing functional and non-functional requirements of the system.

b) The resulting requirements document is a legally binding agreement with the stakeholders.

c) Not necessarily does every requirement have to define a positive end-result.

d) None of the above

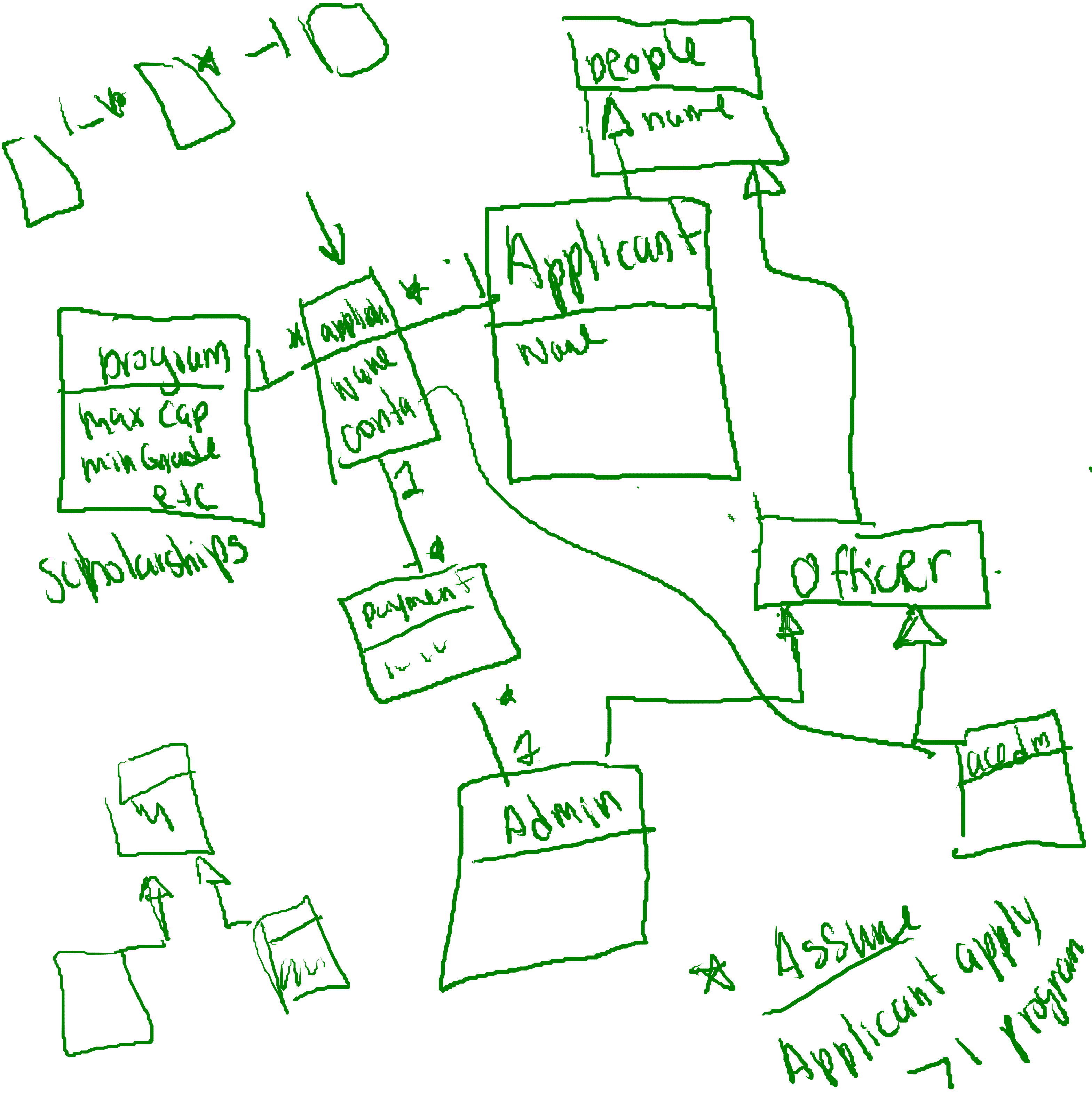
18. Which of the following are good practices writing requirements?

a) Avoid using vague wording such as (usually, generally, often, normally, typically, etc.)

b) Avoid getting customer feedback often throughout the process, as non-technical customers can make the requirements formalization more difficult.

c) Avoid expressing suggestions or possibilities, as those are usually ignored by developers.

d) Avoid setting unrealistic goals and expectations.



* Assume Applicant apply -> 1 program

Part 2 - UML Design (36 marks)

ANSWER THE REMAINING QUESTIONS IN THE SPACE PROVIDED. WRITE YOUR ASSUMPTIONS AS NEEDED.

System specification: Online Application System for Undergraduate Programs

You work as a software engineer at a university. The administration wants to build a system for managing applications to the undergraduate programs and you are required to design a UML Class Diagram for the proposed system.

The system should receive applications from people interested in joining a specific program. Each program has a maximum capacity of accepted students, a minimum grade point average for acceptance, and a number of required recommendation letters. For each program, there is an administrative officer (responsible for checking applications for completeness), and an academic officer (responsible for making decisions on applications). Interested applicants would submit their applications to a specific program.

Each application contains information about the applicant name, contact information (email, phone number, and address), in addition to other information relating to the applicant's status (international or domestic student) and additional documents required by the program. Attri.

When submitting the application, the applicants must pay an application fee (different for each program). The accepted method of payment is using a credit card. The system must store the payment information including the selected payment method, payment date, credit card information (name of card holder and card number only).

The system should keep track of the application status (checking completeness, under academic review, accepted, rejected and waiting list).

Finally, scholarships are offered by different programs for highly qualified candidates. A scholarship is for a specific amount of money and is given for a set number of terms.

19. (8 points) Write four functional and 4 four non-functional requirements for the system described below. From the non-functional requirements, two of them must be platform requirements.

System

people

program
- max Cap
- min Grade
- NumReq

Non Functional
- record applications
- built using agile
- System must be built by DATE
- Product model must be fished & showcased by DATE

20. (28 marks) Create a UML class diagram for the system below.

    - Show all attributes (data types are NOT required),
    - Show all associations and generalizations. Make sure you include the correct multiplicity.
    - Methods and access modifiers are not required and will NOT be graded.

Write your assumptions here (if any):

(Space for your UML class diagram)

(draft page, can be removed from the examination)