Student Name: _____ Student ID # _____

OU Academic Integrity Pledge
On my honor I affirm that I have neither given nor received inappropriate aid in the completion of this exercise.

Signature: _____ Date: _____

Notes Regarding this Examination

Open Book(s) You may consult any printed textbooks in your immediate possession during the course of this examination.
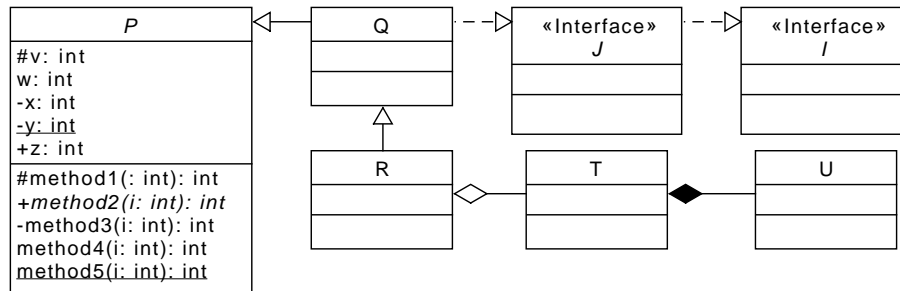
Open Notes You may consult any printed notes in your immediate possession during the course of this examination.

No Electronic Devices Permitted You may not use any electronic devices during the course of this examination, including but not limited to calculators, computers, and cellular phones. All electronic devices in the student's possession must be turned off and placed out of sight (for example, in the student's own pocket or backpack) for the duration of the examination.

Violations Copying another's work, or possession of electronic computing or communication devices in the testing area, is cheating and grounds for penalties in accordance with school policies.

Part I. Object-Oriented Design Components & UML

Refer to the following (partial) UML class diagram when answering the questions in this part.

1. (3 points) What is the relationship between P and Q?
   A. P is a subclass of Q
   B. Q is a subclass of P
   C. P implements Q
   D. Q implements P
   E. P "is a" Q

2. (3 points) What is the relationship between P and R?
   A. R "has a" P   B. R is an ancestor of P
   C. P is a descendant of R
   D. R is a descendant of P
   E. No relationship

3. (3 points) What is the relationship between R and T?
   A. R "has a" T
   B. T "has a" R
   C. T implements R
   D. R is an ancestor of T
   E. T is an ancestor of R

4. (3 points) What is the relationship between T and U?
   A. T "has a" U
   B. U "has a" T
   C. T implements U
   D. U is an ancestor of T
   E. T is an ancestor of U

5. (3 points) What is the relationship between Q and J?
   A. Q "has a" J
   B. J "has a" Q
   C. Q implements J
   D. Q is an ancestor of J
   E. J is an ancestor of Q

6. (3 points) What is the relationship between J and I?
   A. I "has a" J
   B. J "has a" I
   C. I implements J
   D. I is an ancestor of J
   E. J is an ancestor of I

7. (3 points) Which method of P is not an instance method?
   A. `method1`
   B. `method2`
   C. `method3`
   D. `method4`
   E. `method5`

8. (3 points) Which method of P is not an instance method?
   A. `method1`
   B. `method2`
   C. `method3`
   D. `method4`
   E. `method5`

9. (3 points) Which variable of P is protected?
   A. `v`
   B. `w`
   C. `x`
   D. `y`
   E. `z`

Part II. Object-Oriented Design

Refer to the following description when answering the questions in this part.

Dominik and Natalia want to design a software system to keep track of information about their graphic novels. Each graphic novel is a creative work with a title that features one or more characters, was drawn by one or more artists, was written by one or more writers, was edited by one or more editors, and was published by a publishing company. Artists, writers, and editors are the creators of the graphic novel. The creators are all real people, while the characters appearing in the graphic novels may be real or may be fictional individuals and may be people or other types of creatures (real or fictional). People have names and, if they are creators, may fulfill one or more creative role (artist, writer, and/or editor) with respect to any given graphic novel and may work on one or more graphic novels in each role. Characters have names and characteristics and may appear in one or more graphic novels.

Data for this system will be stored to and retrieved from files in two formats – a human-readable text format and a machine-readable binary format.

10. (4 points) Which of the following is not an appropriate class for this software?
    A. `Driver`
    B. `Person`
    C. `ReadFile`
    D. `Character`
    E. `Artist`

11. (4 points) Which interface should be implemented to allow for binary I/O?
    A. `Serializable`
    B. `Cloneable`
    C. `Comparable`
    D. `ObjectInputStream`
    E. `readObject`

12. (4 points) Which relationship should not be included in this design?
    A. A `Character` "has a" `Characteristic`
    B. A `GraphicNovel` "has a" `Character`
    C. A `Character` "has a" `Name`
    D. A `Character` "has a" `GraphicNovel`
    E. `People` "has a" `Name`

13. (4 points) Which relationship should not be included in this design?
    A. An `Artist` "is a" `Creator`
    B. A `Person` "is an" `Artist`
    C. A `Creator` "is a" `Person`
    D. A `GraphicNovel` "is" `Serializable`
    E. A `Person` "is" `Comparable`

14. (4 points) Which method should not be included in this design?
    A. `readFile`
    B. `Person`
    C. `getName`
    D. `setArtist`
    E. `Collections.sort`

15. (4 points) Which field should not be included in `GraphicNovel`?
    A. `title`
    B. `artists`
    C. `characters`
    D. `people`
    E. `publisher`

16. (4 points) For this software, `Person` should be which of the following?
    A. An interface
    B. An abstract class
    C. A concrete class
    D. A method
    E. A field

Part III. Short Questions

17. (5 points) To enforce encapsulation, it would be better to use which accessibility modifier for *class* variables?

A. protected
B. private
C. enforced
D. public
E. default (no modifier)

18. (5 points) To enforce encapsulation, it would be better to use which accessibility modifier for *instance* variables?

A. protected
B. private
C. enforced
D. public
E. default (no modifier)

19. (5 points) Which class signature reflects the best object-oriented programming?

A. `public Class Student extends Person`
B. `public Class Person extends Student`
C. `public Class Person extends Name`
D. `public Class Person implements Name`
E. `public Class StudentID implements Student`

20. (5 points) Dynamic Method Binding is necessary when which other type(s) of polymorphism are present?

A. overloading and overriding
B. multiple inheritance
C. overriding and subclass assignment
D. constructor chaining
E. subclass assignment

21. (5 points) Which is *not* true of Generics in Java?
    A. They reduce the amount of casting used.
    B. They help to ensure type safety.
    C. They promote code reuse.
    D. They allow for multiple inheritance.
    E. They can restrict subclass assignment.

22. (5 points) What is an advantage of `LinkedHashSet` over `HashSet`?
    A. `LinkedHashSet` does not require a contiguous block of memory.
    B. `LinkedHashSet` is faster for insertions than `HashSet`.
    C. `LinkedHashSet` does not require the user to override `hashCode`.
    D. `LinkedHashSet` uses less memory than `HashSet`.
    E. `LinkedHashSet` preserves the insertion order of the elements.

23. (5 points) To be able to sort data based on different criteria you should implement which interface?
    A. `Collections.sort`
    B. `Comparator`
    C. `compareTo`
    D. `binarySearch`
    E. `Serializable`

24. (5 points) Methods that use indexes should be declared where?
    A. `Iterable`
    B. `Collection`
    C. `List`
    D. `AbstractList`
    E. `ArrayList`

25. (5 points) Unit tests should be written during which development phase?
    A. Specification
    B. Program Design
    C. Implementation
    D. Integration
    E. Maintenance