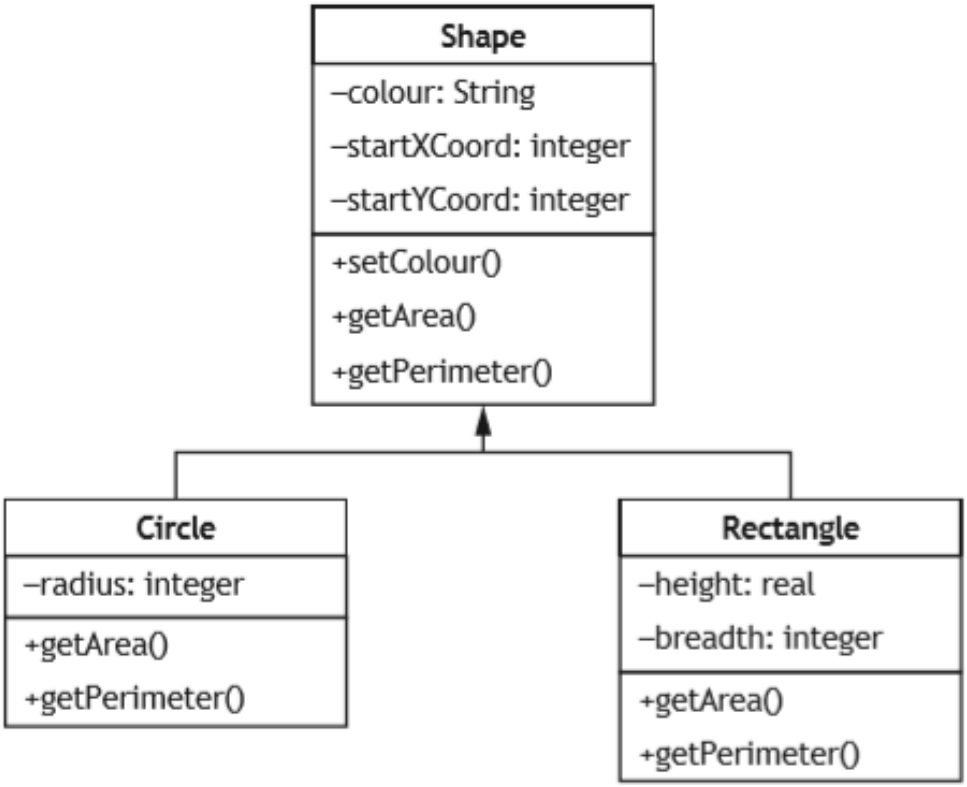
Exam style – Example Questions

Example 1



Using appropriate object-oriented terminology, explain why the following statement would be invalid.

```
SET shape1.colour TO "blue"
```

2

The `getArea()` methods of the `Shape` and `Rectangle` classes are shown below.

Shape class

```
FUNCTION getArea() RETURNS REAL
    SET area TO 0.0
    RETURN area
END FUNCTION
```

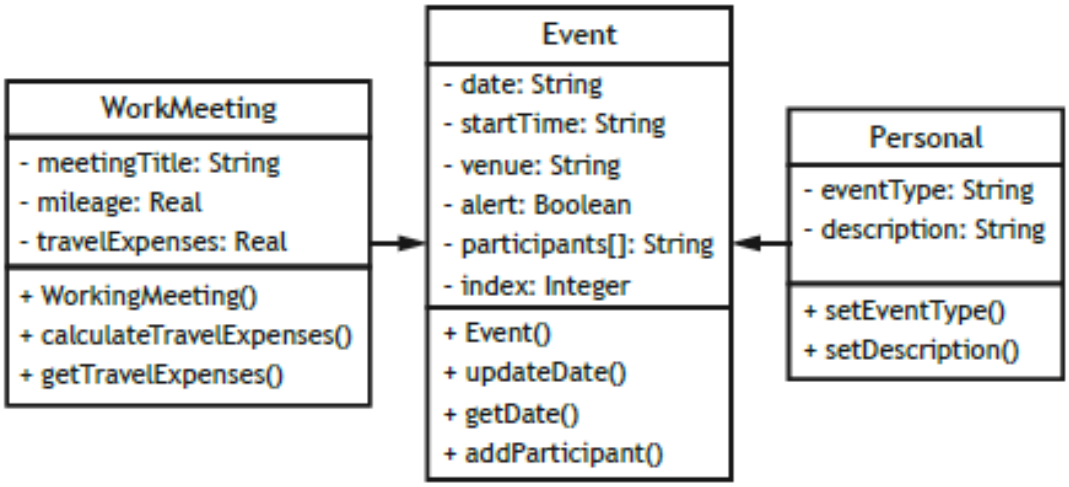
Rectangle class

```
OVERRIDE FUNCTION getArea() RETURNS REAL
    SET area TO THIS.length * THIS.breadth
    RETURN area
END FUNCTION
```

Using appropriate object-oriented terminology, explain the use made of the `OVERRIDE` statement in the `getArea()` method of the `Rectangle` class. 2

Expected response	Max mark	Additional guidance
Encapsulation has been used to restrict access to the `colour` variable. This variable can only be accessed using the `setColour()` method of the `Shape` class.	2	1 mark for encapsulation or use of private property. 1 mark for method required to edit the contents of the variable.
The `OVERRRIDE` statement is used to redefine the `getArea()` method that was inherited from the `Shape` class.	2	1 mark for use of `OVERRIDE`. 1 mark for inherited method.

Example 2




```
Line 1   CLASS Event IS { STRING date, STRING startTime, STRING venue,
         BOOLEAN alert, ARRAY OF STRING participants, INTEGER index }

Line 2     METHODS
Line 3       CONSTRUCTOR ( STRING date, STRING startTime, STRING venue,
             BOOLEAN alert )
Line 4         DECLARE THIS.date INITIALLY date
Line 5         DECLARE THIS.startTime INITIALLY startTime
Line 6         DECLARE THIS.venue INITIALLY venue
Line 7         DECLARE THIS.alert INITIALLY alert
Line 8         DECLARE THIS.participants INITIALLY [NULL] * 20
Line 9         DECLARE THIS.index INITIALLY 0
Line 10      END CONSTRUCTOR

Line 11      PROCEDURE updateDate(STRING eventDate)
Line 12        SET THIS.date TO eventDate
Line 13      END PROCEDURE

Line 14      FUNCTION getDate() RETURNS STRING
Line 15        RETURN THIS.date
Line 16      END FUNCTION

Line 17      PROCEDURE addParticipant(STRING name)
Line 18        SET THIS.participants[index] TO name
Line 19        SET index TO index + 1
Line 20      END PROCEDURE

Line 21  END CLASS
```

Sample Questions

Using a programming language of your choice, write the code equivalent to Line 1 of the `Event` class, for the declaration for the `WorkMeeting` class. 2

Describe the use of the `Constructor` method in the `Event` class. 1

(i) Using appropriate object-oriented terminology, explain the operation and effect of executing the following code. 2

```
DECLARE sales INITIALLY WorkMeeting ( "22/6/19",
"14:00", "Head Office", false, "June sales meeting",
12.0, 0.0 )
```

(ii) Explain the effect of executing the following code. 2

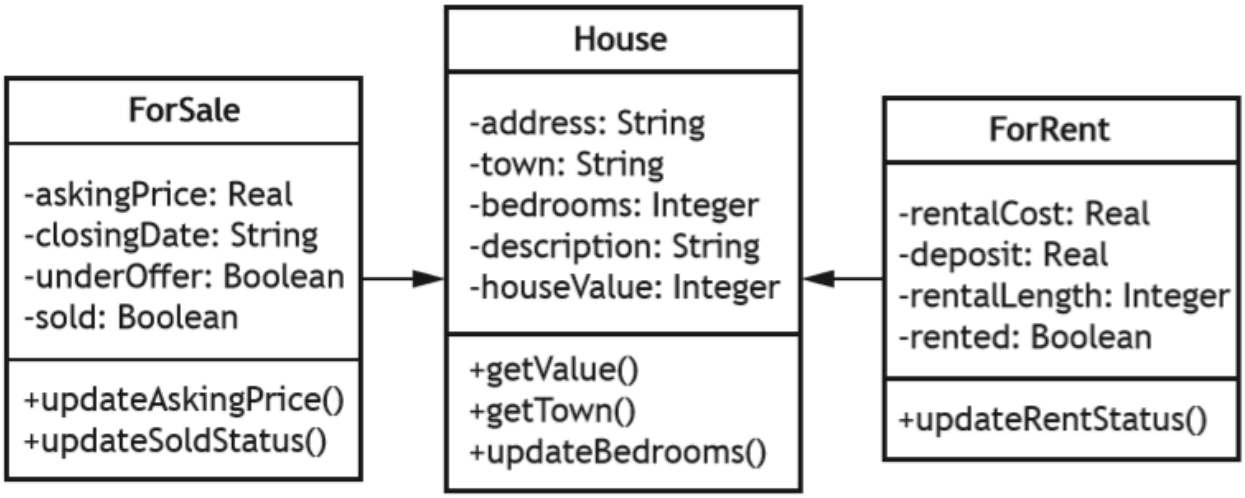
```
sales.addParticipant("Chao Li")
```

(iii) The venue for the event called `sales` has been changed.

By referring to the UML class diagram and using appropriate object-oriented terminology, explain why it is not possible to edit the value already assigned to the `venue` property. 2

on	Expected response	Max mark	Additional guidance
	`CLASS WorkMeeting INHERITS Event WITH { STRING meetingTitle, REAL mileage, REAL travelExpenses }`	2	1 mark for class declaration indicating use of inheritance 1 mark for additional attributes; only award mark for nine attributes if no inheritance indicated
	The constructor assigns initial values upon instantiation of an object.	1	Description must mention creation/instantiation of an object.
(i)	A new object of the `WorkMeeting` subclass has been instantiated (1 mark) The values are assigned to the relevant instance variables with the constructor initialising an empty array to store the list of participants and initialising the array index as zero (1 mark)	2	Award 1 mark each for 2 of the following: • instantiation/creation of object or invoke constructor method for WorkMeeting class • assignment using the 7 values provided and additional two attributes of Event class
(ii)	Award 1 mark each for any two of the following: • A new participant called Chao Li has been added to the array of meeting participants • and the array index is incremented • Invoke addParticipants() method	2	
(iii)	Encapsulation means that a property cannot be edited directly. (1 mark) A method needs to exist in order to update the venue property. (1 mark)	2	1 mark for encapsulation/private variable 1 mark for need for method

Example 3




```
Line 1   CLASS House IS {STRING address, STRING town, INTEGER
         bedrooms, STRING description, INTEGER houseValue}

Line 2   METHODS

Line 3       CONSTRUCTOR (STRING address, STRING town, INTEGER
             bedrooms, STRING description, INTEGER houseValue)
Line 4           DECLARE THIS.address INITIALLY address
Line 5           DECLARE THIS.town INITIALLY town
Line 6           DECLARE THIS.bedrooms INITIALLY bedrooms
Line 7           DECLARE THIS.description INITIALLY description
Line 8           DECLARE THIS.houseValue INITIALLY houseValue
Line 9       END CONSTRUCTOR

Line 10      PROCEDURE updateBedrooms (INTEGER noOfBedrooms)
Line 11          SET THIS.bedrooms TO noOfBedrooms
Line 12      END PROCEDURE

Line 13      FUNCTION getTown() RETURNS STRING
Line 14          RETURN THIS.town
Line 15      END FUNCTION

Line 16      FUNCTION getValue() RETURNS INTEGER
Line 17          RETURN THIS.houseValue
Line 18      END FUNCTION

Line 19  END CLASS
```

Sample Questions

Using appropriate object-oriented terminology, explain the operation and effect of executing the following code.

(i) `DECLARE saleHouse1 INITIALLY ForSale ("12 Albert Road", "Dundee", 2, "Well presented bungalow", 140000, 150000, "20/6/18", FALSE, FALSE)` 2

(ii) `saleHouse1.updateBedrooms(3)` 2

Using appropriate object-oriented terminology, explain why the following statements would be invalid.

(i) `SET saleHouse1.description TO "Well presented house with garden."` 2

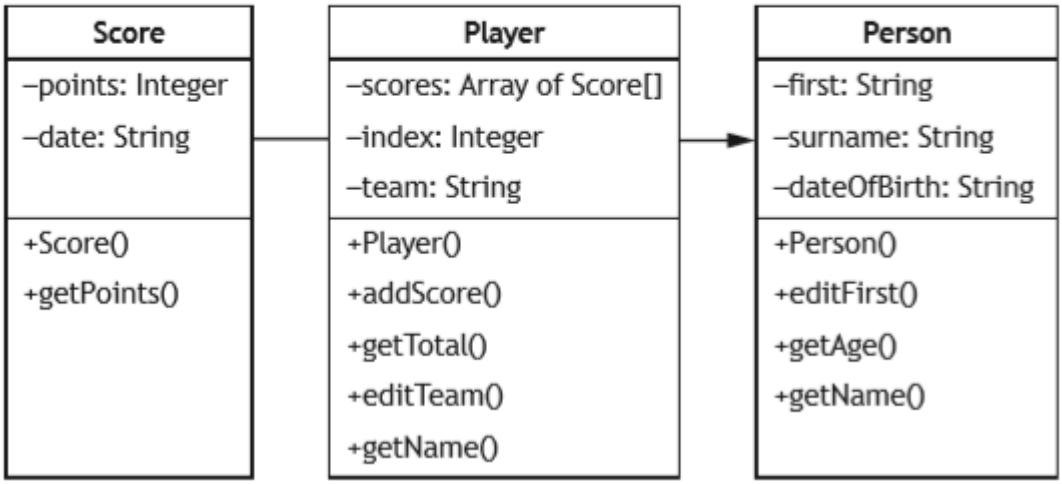
(ii) `saleHouse1.updateRentStatus(TRUE)` 1

(i)	Instantiates an object (called saleHouse1) that belongs to the `ForSale` class (with given values/actual parameters).	2	1 mark each for any 2 of the following: • instantiates/create object • class or using values/parameters • constructor method invoked.
(ii)	The procedure call invokes the `updateBedrooms` method of the `saleHouse1` object (with the value/actual parameter 3). The method `updateBedrooms` is inherited from `House` superclass. A value of 3 is assigned to the property `bedrooms` (in the `saleHouse1` object).	2	1 mark each for any 2 of the following: • invoking method (or procedure) • use made of inheritance • updating property.
(i)	Encapsulation has been used to restrict access to the description variable/property. This property can only be accessed through methods in `ForSale` class (or inherited methods from `House` class).	2	1 mark for encapsulation or use of private property. 1 mark for method required to use/change property.
(ii)	Since the `updateRentStatus` method is not part of `saleHouse1` object. OR The `updateRentStatus` method is only available to objects that belong to the `ForRent` class.	1	

Example 4

An object-oriented program is used to store and return statistics about basketball teams and their players.

A simplified version of the UML class diagram for the program is shown below.



Some of the program code is shown below.

```
...
Line 20    CLASS Person IS { STRING first, STRING surname,
           STRING dateOfBirth }

Line 21    METHODS

Line 22       CONSTRUCTOR ( STRING first, STRING surname,
                            STRING dateOfBirth )
Line 23          DECLARE THIS.first INITIALLY first
Line 24          DECLARE THIS.surname INITIALLY surname
Line 25          DECLARE THIS.dateOfBirth INITIALLY dateOfBirth
Line 26       END CONSTRUCTOR

Line 27       PROCEDURE editFirst( STRING first )
Line 28          SET THIS.first TO first
Line 29       END PROCEDURE
...
...

Line 35       FUNCTION getName() RETURNS STRING
Line 36          DECLARE outputPhrase AS STRING
Line 37          SET outputPhrase TO "My name is " & THIS.first
                 & " " & THIS.surname & " and I like basketball"
Line 38          RETURN outputPhrase
Line 39       END FUNCTION

Line 40    END CLASS
```

```
...
Line 60    CLASS Player INHERITS Person WITH { ARRAY OF Score
           scores, INTEGER index, STRING team }

Line 61    METHODS

Line 62       CONSTRUCTOR ( STRING first, STRING surname,
              STRING dateOfBirth, STRING team )
Line 63          DECLARE THIS.first INITIALLY first
Line 64          DECLARE THIS.surname INITIALLY surname
Line 65          DECLARE THIS.dateOfBirth INITIALLY dateOfBirth
Line 66          DECLARE THIS.team INITIALLY team
Line 67          DECLARE THIS.scores AS ARRAY OF Score INITIALLY
                 []
Line 68          DECLARE THIS.index INITIALLY 0
Line 69       END CONSTRUCTOR
...
...
Line 101   DECLARE person1 AS Person INITIALLY ( "Wayne",
           "Nowitzki", "19/06/1990" )
Line 102   person1.editFirst( "Dwayne" )
Line 103   SEND person1.getName() TO DISPLAY
...
```

(a) Using appropriate object-oriented terminology, explain the operation and effect of

(i) Line 101 of the program **2**

(ii) Line 102 of the program. **2**

(b) State the output generated by Line 103 of the program. **1**

(c) (i) Amanda Greene was born on 26th April 1987 and she has signed up to play basketball for the Burnside Braves.

Using a programming language of your choice, write the line of code needed to instantiate a `Player` object called `player2` to store Amanda's details. **1**

(c) (ii) The following line of code is added to the program.

```
player2.getName()
```

The output produced by the program is shown below.

```
My name is Amanda Greene and I play basketball for the Burnside Braves.
```

Explain the meaning of the term polymorphism by making reference to the `getName()` methods in this program. **2**

(d) The `addScore()` method of the `Player` class is shown below.

```
Line 70   PROCEDURE addScore(newPoints, when)
Line 71     SET result TO Score INITIALLY (newPoints, when)
Line 72     SET THIS.scores[THIS.index] TO result
Line 73     SET THIS.index TO THIS.index + 1
Line 74   END PROCEDURE
```

Using appropriate object-oriented terminology, explain the operation and effect of the following line of code. **3**

```
player2.addScore(23, "27/01/2019")
```

(e) The `getTotal()` method of the `Player` class is used to calculate and return the total score for an individual player.

Using a programming language of your choice, write the code needed to implement the `getTotal()` method. **3**

uestion		Expected response	Max mark	Additional guidance
(a)	(i)	A new object of the `Person` class has been instantiated **AND** populated with a value for each instance variable in the class.	**2**	1 mark for instantiation of an object of `Person` class. 1 mark for assignment of values to instance variables of the `Person` class.
	(ii)	This code is used to invoke the `editFirst()` method of the `person1` object (with the value/actual parameter 'Dwayne'). Changes the value of the instance variable `first` (in the `person1` object) to Dwayne.	**2**	1 mark for invoking `editFirst()` method. 1 mark for updating the instance variable `first` of the `person1` object.
(b)		My name is Dwayne Nowitzki and I like basketball.	**1**	
(c)	(i)	`SET player2 AS Player INITIALLY ("Amanda", "Greene", "26/04/1987", "Burnside Braves")`	**1**	All four values must be used correctly.
	(ii)	Polymorphism refers to the ability to redefine the `getName()` method of the `Player` subclass that has been inherited from the `Person` super class. The inherited code is overwritten meaning that the subclass and class respond differently to any message received.	**2**	1 mark for ability to redefine the inherited `getName()` method. 1 mark for ability to respond differently to the same message.
(d)		A new element (consisting of a score and date) is added to the array of `Score` objects that belongs to the `Player` object called `player2`. The index of the `scores` array (the array of `Score` objects) is incremented by adding one to the class variable `numberGames` that belongs to the `Player` class.	**3**	1 mark for correct use of the array of `Score` objects in explanation. 1 mark for correct relationship between `Score` and `Player` objects used in explanation. 1 mark for appropriate reference to indexing of the `scores` array by incrementing the class variable.

Question			Expected response	Max mark	Additional guidance

8.	(e)		`FUNCTION getTotal() RETURNS INTEGER`
			
			`  DECLARE totalScore`
			`  INITIALLY 0`
			
			`  REPEAT FROM 0 TO`
			`  THIS.index - 1 DO`
			`  SET totalScore TO`
			`  totalScore +`
			`  scores.getPoints[THIS`
			`  .index]`
			`  END REPEAT`
			
			`  RETURN totalScore`
			
			`END FUNCTION`
				3	1 mark for initialising and correctly updating the local variable `totalScore`.
					
					1 mark for loop making correct use of the instance variable `index` and returning the calculated `totalScore`.
					
					1 mark for correct use of `getTotal()` method of the `scores` array.