Encapsulation is the process of restricting/ protecting attributes, to reinforce their scope. This is mainly done via scope keywords ‘public’ (accessed from inside and outside class), ‘protected’ (accessed only from the class, and sub-classes), ‘private’(accessed only from the class). The compiler ensures these scopes directly, preventing compilation if the scope is not respected.

Accessor and mutator methods allow for retrieving and modifying the data from outside the class, ensuring there is no accidental change to the data. Mutators can also be used to validate the new value of an attribute e.g. in my code the setConfidence() method will only change the attribute if the new value is between 0.0 and 1.0(inclusive).

For Horse:

* Accessor methods: getConfidence(); getDistanceTravelled(); getName(); getSymbol()
* Mutator methods: setConfidence(); setSymbol()

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A screen shot of a computer code

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(trying to access a private attribute directly leading to error)

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(using an accessor to get the value of a private attribute)

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(Using a mutator to change the value of an attribute of an object)

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(Passing an invalid input to a mutator, validation of the mutator prevents incorrect change)

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(Testing with boundary confidence value 0.0- denied)

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(Passing a valid value to a mutator)

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(Testing if the value of fallen attribute changes correctly after falling via fall(), and resetting after a fall via goBackToStart())

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(Testing horse movement, via moveForward() and movement reset via goBackToStart() )

Issues:

* Race moves too fast, playing out and ending faster than the video.
  + Increase the timeout parameter in TimeUnit.MILLISECONDS.sleep().

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* + Compiler now waits longer between frames/states of the race providing a smoother progression, closer to the video.
* Current code does not display the horse’s name and current confidence, adjacent to their lane.
  + Added line of code at the end of the printLane() method to print these attributes of the passed in horse object when the lane is done printingA screen shot of a computer program

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* Code does not account for the event of a tie between horses(Not in the video or the instructions but should be pointed out)
  + There is also nothing in Phase 2 that requires us to implement it hence this is potential area of improvement identified by me

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* + There can be 3 outcomes: tie, one winner, no winner yet. This means ideally, we would look at displaying the winner(s) only after checking each horse for winning. The winners would need to somehow be recorded to display them later(in the event of a tie). Due to the ability to add more horses which will be added in Phase 2, I chose to use an ArrayList that can be dynamically extended. This records any winning horse and passes it to printWinners()
  + printWinners() could be inside startRace() but I believe separating it makes the code more legible. If there are no winners it simply moves on, but if there are 1 or more winners it only prints them appropriately.
* Invalid races – the current code has no way of dealing with races that go on forever. Specifically, if all horses have fallen
  + Horse has fallen
  + Horse has had their confidence reduced to 0.0

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(also modified the code to use a loop to call moveHorse() on all horses

* Calls the method that inspects all horses, checking if all of them are unable to continue at which point, since it will come up false in the while statement, it output the suspending race message and ends the code.
* Its position in the while loop should ensure it is called both before the race begins, and before the next race state is printed.
* Terminal would not clear correctly, instead outputting states of the race consecutively. (this is more of a personal issue likely due to how the windows terminal works) A blue screen with white text

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  + Ended up altering the string in the line meant to clear the terminal as someone with the same problem received feedback in the forum. This is likely due to terminal commands in Windows simply being different.
  + <https://qmplus.qmul.ac.uk/mod/forum/discuss.php?d=584924>
* Horse confidence will not change, as race cannot be repeated within the same iteration of the program. Program must be rerun, which resets the horse objects. This means 2 new “mechanics”.
  + Ability to run another race with the same horses
  + Modifying each horse’s confidence if they win a race(increase) or fall(decrease) A screen shot of a computer program

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* Separated the loop that calls goBackToStart() for all horses, so it can be called from 2 places: before the first race(ensure everything is in its right place) and after every subsequent race
* Added a generic method for taking input from the user
* Added an if statement checking after every new race state, whether there have been any winners
  + Instead of running 2 checks (1 for tie, 1 for solo winner) every iteration it only runs one, until the final iteration where it will be 3, however it would be more efficient this way
  + E.g. 10 operations would have 9+3=12 checks, instead of 10\*2=20.
* If there are winners, it prints the outcome and asks the user if they want to run another race, only ending the program if the user does not input “y” (yes). Winners array list is also cleared upon next race.
* Added the updateHorseConfidence() method which uses the horse’s setConfidence() mutator method to alter their confidence.
  + Called from 2 places: moveHorse(), when the horse falls, and startRace() when a horse has reached the finishing line(won). The first parameter is a reference to the horse object, while the second is a Boolean determining if this is an increase or a decrease
  + The final variable MODIFIER is subject to change as the guide does not specify how the horse’s confidence should change, or even if it is incremented/decremented or set to specific values (at least for now).
  + Validation for the change will be done internally by the Horse object (as detailed above)
* Additionally modified placement of canRaceContinue()
  + Logically since all horses are reset before the while statement, there is no need to check if the race can go on before the race starts.
  + Has been moved to the section checking for winners (which would be after the race has been updated to each new state), indicating the end of the race. This fits as logically all horses falling are another reason for the race to end, it also ensures the user can be asked to restart for every scenario in which the race ends.
* Note: after testing sometimes doubles have issues displaying due to how floating-point math is done. So I quickly wrote a function that rounds the confidence values. A screen shot of a computer program

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* Here the passed in variable 10.0 ensures rounding to 1dp, which may later be changed
* formatter.format(“%+0.1f”, val) also works