**Alcohol testing of drunk drivers Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Task A: The following information is about the testing of 238 drivers using the American Field Sobriety Test.**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Field Sobriety Test** |  |
|  |  | **Fail** | **Pass** |  |
| **Actual Alcohol Status** | **High** | 54 | 10 |  |
| **Low** | 47 | 127 |  |
|  |  |  |  |  |

1. Let Event A be failing the Field Sobriety Test and Event B be having a High Alcohol Status. 

Complete the following table:

|  |  |  |
| --- | --- | --- |
| **Notation** | **Meaning in words** | **Probability**  |
| P(A)  | P(Failing the sobriety test) |  |
| P(B)  |  |  |
| P(A’) |  |  |
|  | P(Not having a high alcohol status) |  |
| P(A$∩$B) |  |  |
| P(A’$∩$B) | P(Not failing the FST AND having a High Alcohol Status) |  |
| P(A’$∩$B’) |  |  |
| P(A$∩$B’) |  |  |
| **Notation** | **Meaning in words** | **Probability**  |
| P(A$∪$B)  | P(Failing the FST OR Having a High Alcohol Status) |  |
| P(A’$∪$B) |  |  |
| P(A’$∪$B’) |  |  |
| P(A$∪$B’) |  |  |
| P(A│B) | P(Failing the FST, given that the driver has a High Alcohol Status) |  |
| P(B│A)  |  |  |
|  | P(Failing the FST, given that the driver does not have a High Alcohol) |  |
| P(B’│A) |  |  |

1. Use the information / definitions on the left to complete the questions on the right of the following table: 

|  |  |
| --- | --- |
| **Information / Definitions**  | **Questions** |
| Two events are ***independent*** if the fact that A occurs does not affect the probability of B occurring. One way of testing this is to see if P(A$∩$B) = P(A) x P(B). If this is true then A and B are ***independent***. | Use this formula to see if Events A and B are ***independent***. |
| Two events are ***complementary*** if they are the only two possible outcomes. | Name two events that are ***complementary****.* |
| What is P(A) + P(A’) always equal to and why? |
| Two events are ***mutually exclusive*** if they cannot occur at the same time. | Name two events that are ***mutually exclusive***. |
| What is P(A$∩$B) for two ***mutually exclusive*** events? Why? |

1. Calculate the following: 

|  |  |  |
| --- | --- | --- |
| P(False Positive) = | P(False Negative)=  | P(Correct test result)=  |
| P(Have high alcohol │ pass the test)= | P(Have high alcohol │ fail the test)= |
| P(Fail the test │ high alcohol)= | P(Fail the test │ low alcohol)= |

1. Write a paragraph about the accuracy of this test for assessing whether a person is unsafe to drive. 

|  |
| --- |
|  |

**Task B: In the New Zealand situation the following information is known:**

* Out of 9691 drivers tested, 8450 passed the Blood Alcohol test.
* Of the 8450 who passed, 52 actually had a high Alcohol Status.
* Out of the 9691 drivers tested, 1177 had high Alcohol Status.
1. Use the information above to complete the following contingency (two-way) table: 

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Blood Alcohol Test** |  |
|  |  | **Fail** | **Pass** |  |
| **Actual Alcohol Status** | **High** |  |  |  |
| **Low** |  |  |  |
|  |  |  |  |  |

1. Let Event A be passing the Blood Alcohol Test and Event B be having a High Alcohol Status. 

Complete the following table:

|  |  |  |
| --- | --- | --- |
| **Notation** | **Meaning in words** | **Probability**  |
| P(A)  |  |  |
| P(B)  |  |  |
| P(A’) |  |  |
| P(A$∩$B) |  |  |
| P(A’$∩$B) |  |  |
| P(A’$∩$B’) |  |  |
| **Notation** | **Meaning in words** | **Probability**  |
| P(A$∪$B)  |  |  |
| P(A’$∪$B’) |  |  |
| P(A$∪$B’) |  |  |
| P(A│B) |  |  |
| P(B│A)  |  |  |
| P(A│B’) |  |  |

1. Complete the following table: 

|  |  |
| --- | --- |
| Are A and B ***independent*** events? Why / why not? |  |
| Are A and B ***complementary*** events? Why / why not? |  |
| Are A and B ***mutually exclusive*** events? Why / why not? |  |

1. Calculate the following: 

|  |  |  |
| --- | --- | --- |
| P(False Positive) = | P(False Negative)=  | P(Correct test result)=  |
| P(Have high alcohol │ pass the test)= | P(Have high alcohol │ fail the test)= |
| P(Fail the test │ high alcohol)= | P(Fail the test │ low alcohol)= |

1. Write a paragraph comparing the accuracy of the two tests. 

|  |
| --- |
|  |