Qn 5

Colorectum cancer is the most common cancer in Hong Kong according to the figures of the CancerFund ([Home -> All About Cancer -> Latest Cancer Statistics](http://www.cancer-fund.org/en/cancer-statistics.html)).

To reduce the onset of Colorectum cancer, the Hong Kong Government is conducting the Colorectum cancer screening programme (<https://www.colonscreen.gov.hk/en/public/programme/background_of_programme.html>).

A patient comes to see a doctor and describes his symptoms. Based on the doctor’s experience, he is **60%** certain that the patient may have Colorectum cancer. He asks the patient to conduct a test, which will give a cancer index number. A number that exceeds the threshold indicates cancer and vice versa.

Suppose that the test has a **false positive rate of 10%** and a **false negative rate of 1%**. What is the conditional probability that the patient has the cancer given that

1. the test indicates that he has the cancer?
2. the test indicates that he does not have the cancer?
3. Do you think the test is useful? Comment.

Yes, it is useful as the probability that the patient has the cancer while the test indicates that he has the cancer goes as high as 93.691%. On the other hand, the probability that the patient has the cancer while the test indicates that he does not have the cancer is only 1.6393%. Thus, the test is useful and reliable.

Qn 6

At a certain stage of criminal investigation, the inspector in charge is **60%** convinced of the guilt of a certain suspect. Suppose now that a new piece of evidence that shows the criminal has a certain characteristic is uncovered. If **20%** of the population possesses this characteristic, how certain of the guilt of the suspect should the inspector now be if it turns out that the suspect is among this group?

Qn 7

Let us now suppose that the new evidence is subject to different possible interpretations, and in fact only shows that it is 90% likely that the criminal possesses this certain characteristic. In this case, how likely would it be that the suspect is guilty (assuming, as before, that he has this characteristic)?