Q1) In the table provided below, the results of a new diagnostic test for Cancer are compared with the complete diagnostic package in current use in a random sample representing the general population. What are the sensitivity, specificity, accuracy, PPV and NPV of the new test. Would you recommend it for screening purposes in the general population? Would you justify its use for diagnosis of Cancer? For what purpose such test is good for?

Q2) A physical examination was used to screen for breast Cancer in 2500 women with biopsy proven adenocarcinoma of the breast and in 5000 age and race matched control women. The results of the physical examination were positive (i.e. a mass was palpated) in 1800 cases and 800 control women (who showed no evidence of cancer at biopsy).

Q3) A colon Cancer screening study is being conducted in a town. Individuals aged 50 to 75 years will be screened with the hemoccult test, a stool sample is tested for the presence of blood (RBCs under microscope). The hemoccult test has a sensitivity of 70% and a specificity of 75%. If the prevalence of ca colon in the population of 50-75 years of age in this town is 20/1000, What is the PPV for this test? Interpret the value of PPV. Use a hypothetical sample of 5000.

Q1) In the table provided below, the results of a new diagnostic test for Cancer are compared with the complete diagnostic package in current use in a random sample representing the general population. What are the sensitivity, specificity, accuracy, PPV and NPV of the new test. Would you recommend it for screening purposes in the general population? Would you justify its use for diagnosis of Cancer? For what purpose such test is good for?

	Complete diagnosis (true disease status)		
New test	Ca Present	Ca absent	Total
+ve	9	1000	1009
-ve	1	9000	9001
Total	10	10000	10010

Sensitivity =	(9/10)x100	=90%
Specificity =	(9000/10000)x100	=90%
Prevalence (pretest probability)=	(10/10010)x100000	=99.9/100,000
PPV =	(9/1009)x100	=0.9%
NPV =	(9000/9001)x100	=99.99%

I would not recommend it for screening purposes although the test is fairly sensitive (90%) because the prevalence of the diseases in general population is very low (99.9 per 100000) resulting in very low PPV (1% only), therefore only 1 in every 100 possible case is really Ca resulting in unnecessary anxiety on the part of false positive Ca cases.

I would not justify its use for establishing the diagnosis of Ca since its PPV is very low (1% only)

The test is suitable to exclude a possible diagnosis of Ca in subjects with no other reason to suspect a Ca in them (like in screening) since its NPV is almost perfect (100%).

Q2) A physical examination was used to screen for breast Cancer in 2500 women with biopsy proven adenocarcinoma of the breast and in 5000 age and race matched control women. The results of the physical examination were positive (i.e. a mass was palpated) in 1800 cases and 800 control women (who showed no evidence of cancer at biopsy).

	biopsy proven adenocarcinoma of the breast		
Physical examination	Ca Present	Ca absent	Total
+ve			
-ve			
Total	2500	5000	7500

What are the sensitivity, specificity, proportion of false positive and false negative test, accuracy, PPV and NPV of physical examination when used to predict Ca breast? What is the pretest probability of breast Ca in the present example?

	biopsy proven adenocarcinoma of the breast		
Physical examination	Ca Present	Ca absent	Total
+ve	1800	800	2600
-ve	700	4200	4900
Total	2500	5000	7500

Sensitivity =	(1800/2500)x100	=72%
Specificity =	(4200/5000)x100	=84%
Prevalence (pretest probability)=	(2500/7500)x100	=33.3%
PPV =	(1800/2600)x100	=69.2%
NPV =	(700/4900)x100	=85.71%
Proportion of false positive=	100-specificity = 100-84	=16%
Proportion of false negative=	100-sensitivity = 100-72	=28%

Q3) A colon Cancer screening study is being conducted in a town. Individuals aged 50 to 75 years will be screened with the hemoccult test, a stool sample is tested for the presence of blood (RBCs under microscope). The hemoccult test has a sensitivity of 70% and a specificity of 75%. If the prevalence of ca colon in the population of 50-75 years of age in this town is 2/1000, What is the PPV for this test? Interpret the value of PPV. Use a hypothetical sample of 5000.

Prevalence = Total diseased / Total sample examined = 2/1000 = 0.002
Sensitivity = T+/total diseased = 0.70
Specificity = T- / total disease free = 0.75.

0.002 = Total diseased / 5000
Total diseased = 5000 x 0.002 = 10

0.70 = T+/10
T+ = 0.70x10=7

0.75 = T- / (5000-10)
T- = 0.75 x 4990 = 3743

	Final diagnosis of Ca colon		
hemoccult test	Ca Present	Ca absent	Total
+ve	T+	F+	
-ve	F-	T-	
Total	Total diseased	Total disease free	5000

	Final diagnosis of Ca colon		
hemoccult test	Ca Present	Ca absent	Total
+ve	7	1247	1254
-ve	3	3743	3746
Total	10	4990	5000

PPV = (7/1254)x100 =0.6%

The PPV is very low. The test is of no use in establishing the diagnosis of Ca colon, since the confidence in its positive value is less than 1%.

Formula used in calculations

	Disease status		
Test results	**Disease positive**	**Disease free**	**Total**
+ve	**(A) True** +ve test	**(B) False** +ve test	Total positive test results
-ve	**(C) False** –ve test	**(D) True** -ve test	Total negative test results
Total	Total cases (disease)	Total non-cases (disease free)	Total sample

Sensitivity = $\frac{\text{Number of true positives}}{\text{Number of diseased people}} = \frac{A}{A+C}$

Proportion of false negative = 1-sensitivity or 100-sensitivity%

Specificity = $\frac{\text{Number of true negative}}{\text{Number of disease free people}} = \frac{D}{B+D}$

Proportion of false positive = 1-specificity or 100-specificity%

Accuracy = $\frac{\text{Number of true +ve and -ve}}{\text{Total sample size}} = \frac{A+D}{A+B+C+D}$

PPV = $\frac{\text{Number of true positive}}{\text{Number of all positive test results}} = \frac{A}{A+B}$

NPV = $\frac{\text{Number of true negative}}{\text{Number of all negative test results}} = \frac{D}{C+D}$