

(Q1-Q4) The table below shows the results of heart failure screening from 100 adult patients undergoing major surgery. The HF expert and the ML algorithm determined whether heart failure was present or absent prior to surgery. Please respond to the following questions.

		HF Expert Review		
		HF	No HF	Total
ML Detection	HF	39	40	79
	No HF	2	19	21
	Total	41	59	100

Note: True Positive Rate = Sensitivity; False Positive Rate = 1 – Specificity

Question 1. What is the **True Positive Rate (TPR)** from the table above?

- A. 39/79
- B. 2/21
- C. 39/41
- D. 40/59
- E. 39/100

Question 2. What is the **False Positive Rate (FPR)** from the table above?

- A. $1 - 39/79$
- B. 2/21
- C. 39/79
- D. $1 - 19/59$
- E. $1 - 39/100$

Question 3. The ML algorithm detected 79 positive cases, 39 true positive and 40 false positive cases. Because of the high number of false positives, this ML algorithm triggers many false alarms, causing preoperative clinicians to be overburdened. In this situation, how would you like to modify its **threshold** (cut-off probability) to reduce the number of false positives?

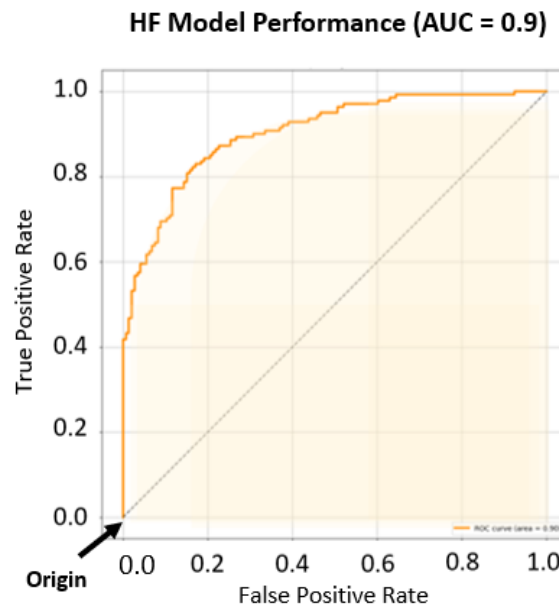
- A. Increase the threshold
- B. Decrease the threshold

Question 4. How would TPR (sensitivity) and FPR ($1 - \text{specificity}$) respond to the threshold change based on your response in Question 3?

- A. TPR increases, FPR increases
- B. TPR decreases, FPR decreases
- C. TPR increases, FPR decreases
- D. TPR decreases, FPR increases
- E. No changes in TPR and FPR

(Q5) In this study, TPR, FPR, and the AUC plot are available to assist your clinical decision. The TPR and FPR follow the line of the curve in the AUC plot based on various thresholds. We want you to be able to describe how TPR and FPR change with respect to various thresholds.

In ML Reference, TPR and FPR are determined by a threshold of HF probability, a likelihood of having HF estimated by the ML algorithm for individual cases. Because the HF probability varies from case to case, TPR and FPR will be set at different thresholds. Although you have no direct access to the threshold, which is HF probability, you can infer it by assessing the TPR and FPR.



Question 5. Based on TPR and FPR in the table below and the AUC plot above, choose the **most** appropriate threshold for each case from the three choices below. The threshold in this study is equivalent to HF probability. You can answer High, Moderate, or Low.

Threshold (= HF probability):

Choice 1. Threshold is set to 92% (High)

Choice 2. Threshold is set to 51% (Moderate)

Choice 3. Threshold is set to 13% (Low)

	TPR & FPR	Threshold (= HF Probability)
Case #1.	TPR=73%, FPR=11%	
Case #2.	TPR=98%, FPR=64%	
Case #3.	TPR=1%, FPR=0%	

Hint:

- The TPR & FPR toward the origin (0, 0) in the AUC plot means a higher threshold.
- You can find this in the [e-Learning video](#) between 12:20 and 16:20 seconds.