Bayes' Theorem
Instructions

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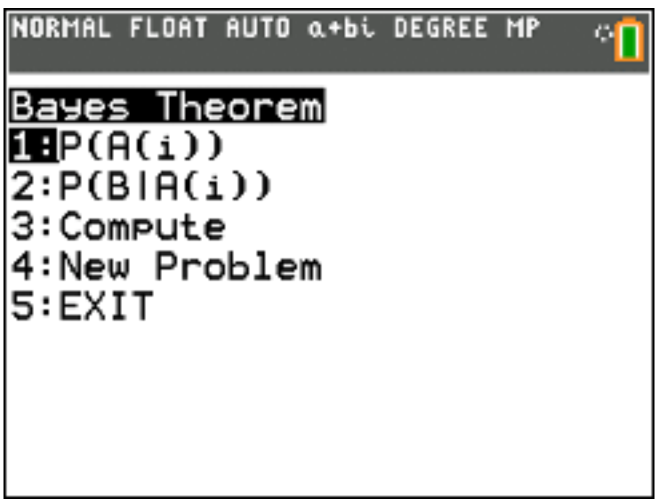
When dealing with conditional probabilities it can be important to revise those probabilities when new information is obtained. For example, a firm uses parts from two suppliers. It gets 65% of its parts from supplier 1 and 35% from supplier 2. Based on historical data, the firm estimates that supplier 1's shipments contain 2% bad parts and supplier 2's shipments contain 5% bad parts.

A machine breaks down when processing a bad part. What is the probability it came from supplier 1 or supplier 2? Bayes' Theorem provides a means for making these probability calculations.

Open the BAYESRUL program.

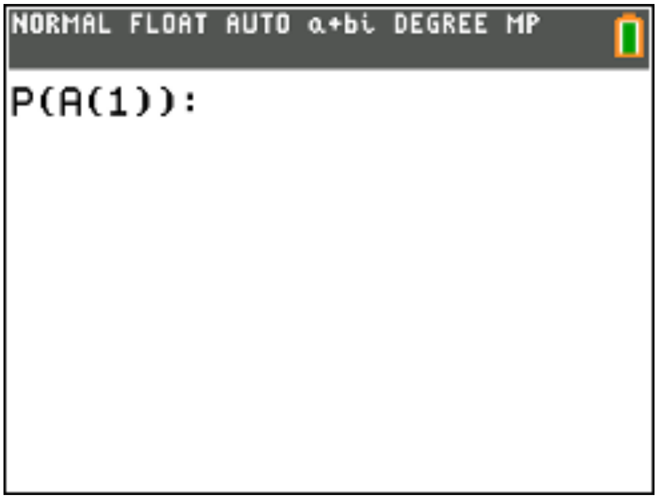


Let A1 = supplier 1
Let A2 = supplier 2.
Let B = bad part.

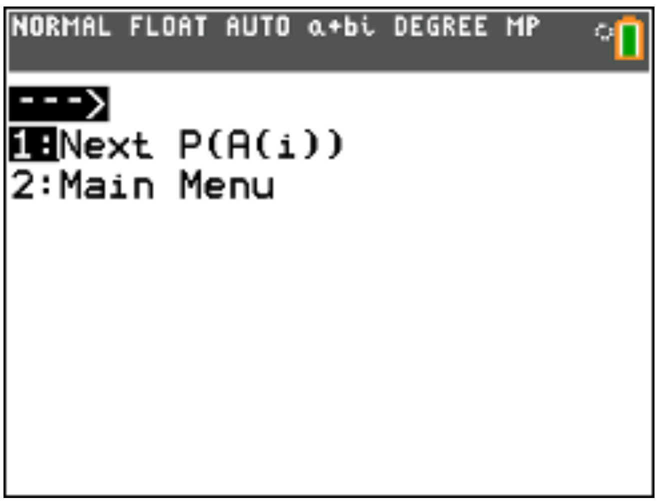
Then: P(A1) = 0.65
P(A2) = 0.35
P(B|A1) = 0.02
P(B|A2) = 0.05

The last two probabilities are conditional probabilities. The probability of a bad part given that it came form supplier 1 is 0.02, for example. The "|" symbol means given.

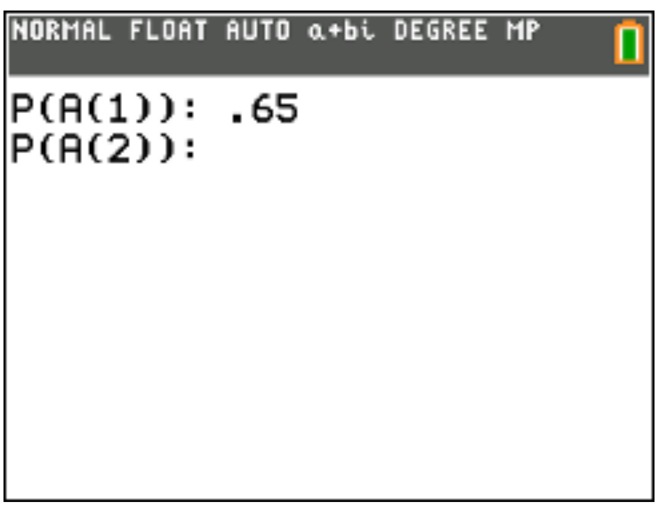
Now press 1 to enter the P(Ai) probabilities.



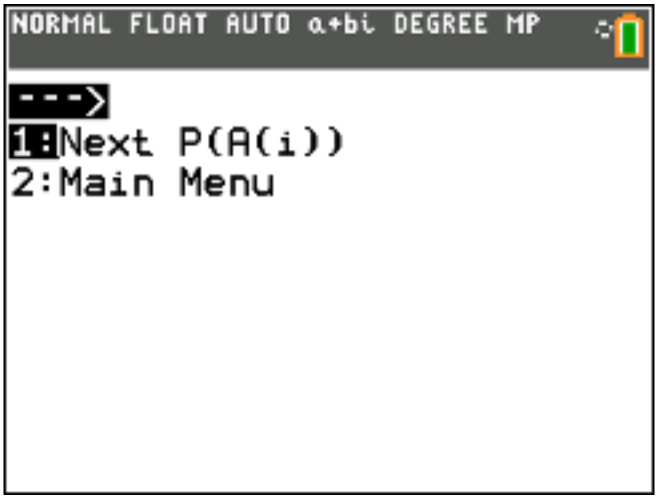
Enter .65 and press the enter key.



Now you have two options. 1—enter the next P(A) or 2-- go the main menu. Press 1.

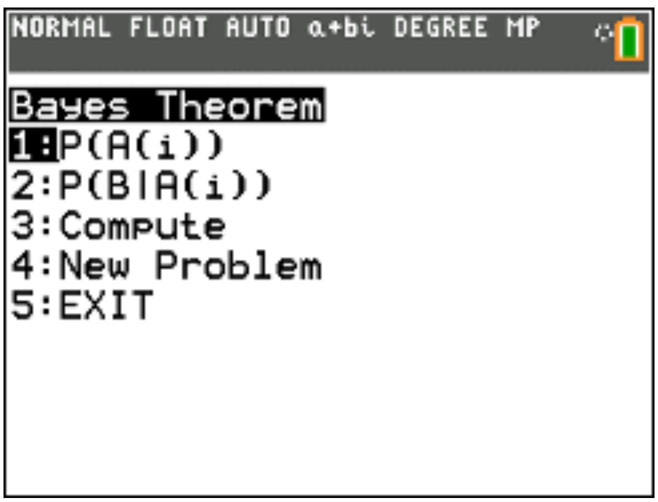


Enter .35 for P(A(2)) and press enter.

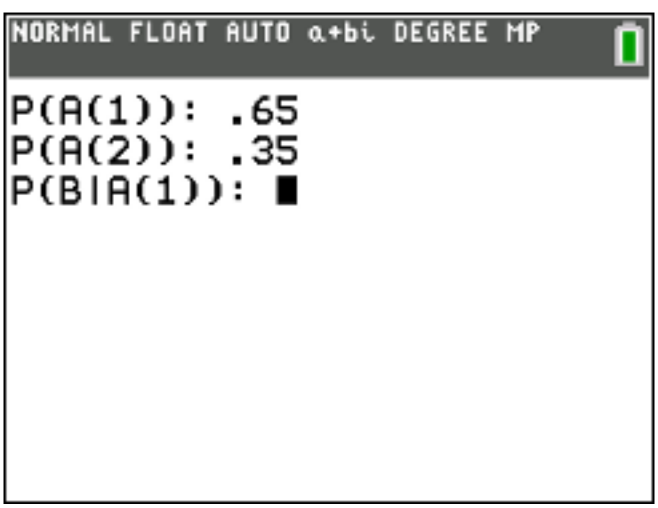


You're back to this menu. Since you have no more probabilities to enter here, press 2.

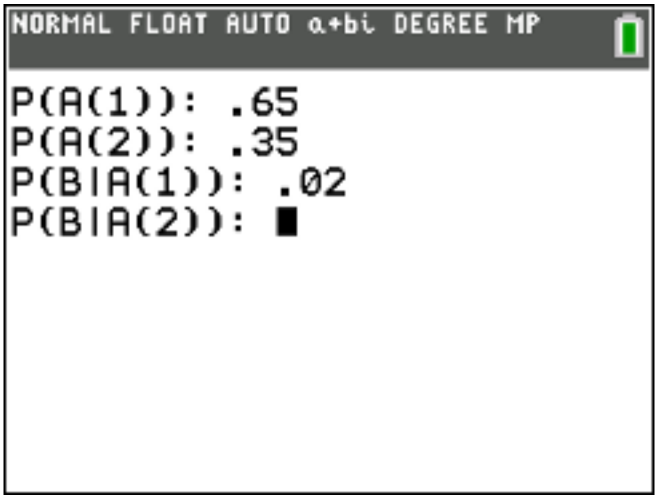
Now we need to enter the probabilities of getting a bad part from the 2 suppliers. Press 2.



Now press 2 the enter the P(B|A(i)) probabilities.

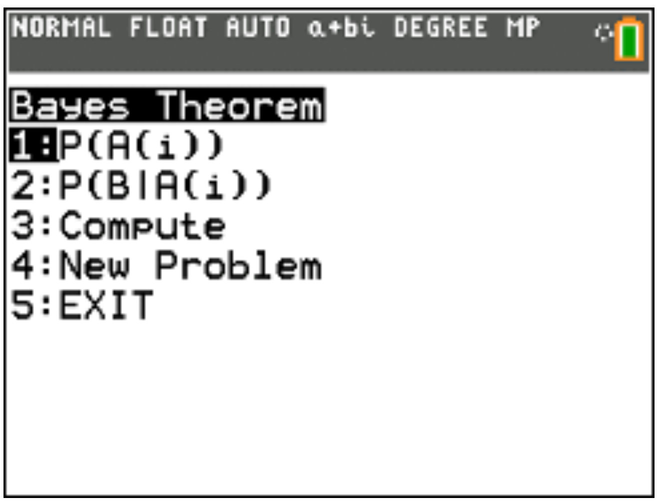


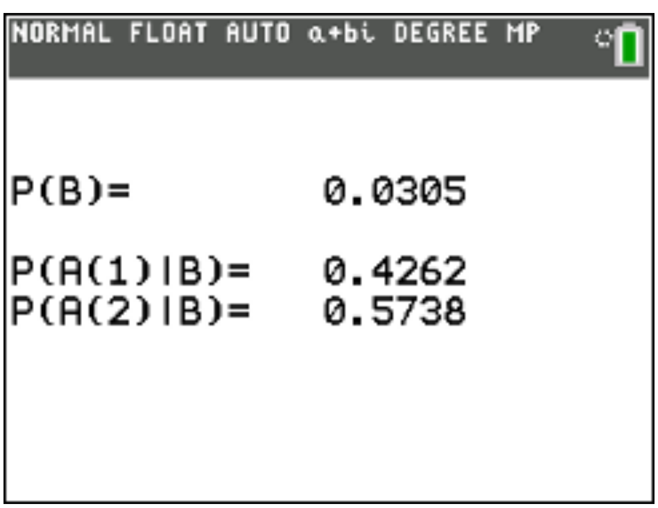
The P(B|A1) is .02, so enter it. Then press 1 to enter the other probability



The second probability is .05, so enter it. And then press 2 to get back to the main menu.

Now compute the revised probabilities. Press 3.



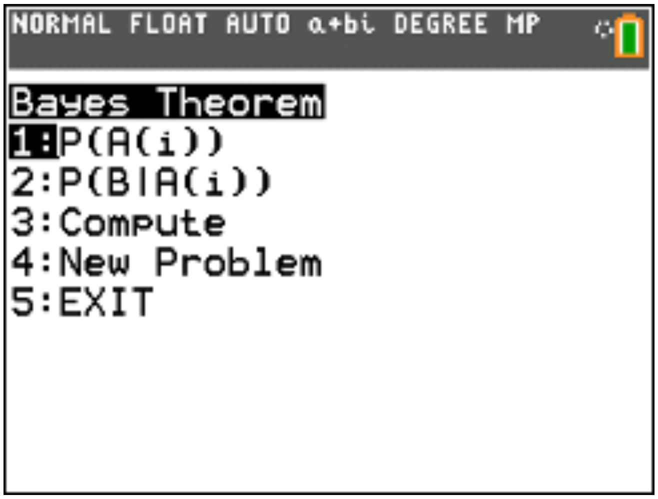


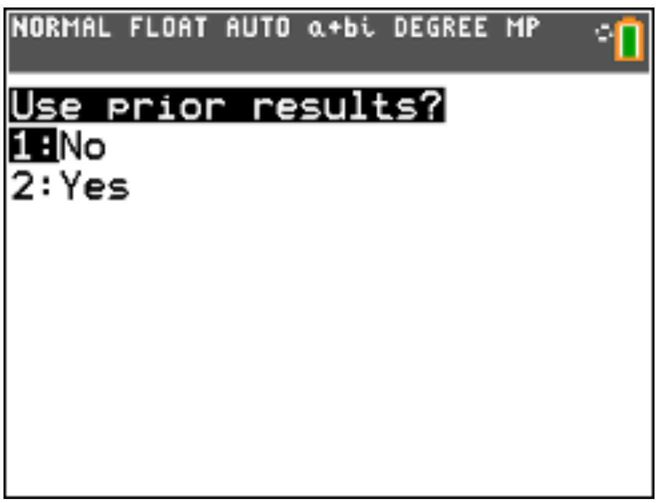
The overall probability of getting a bad part was 0.0305.

But given that the part that messed up the machine was bad, the probability that it came from supplier 1 is 0.4262. And from supplier 2 the probability was 0.5738.

Pressing enter now will get you back to the main menu.

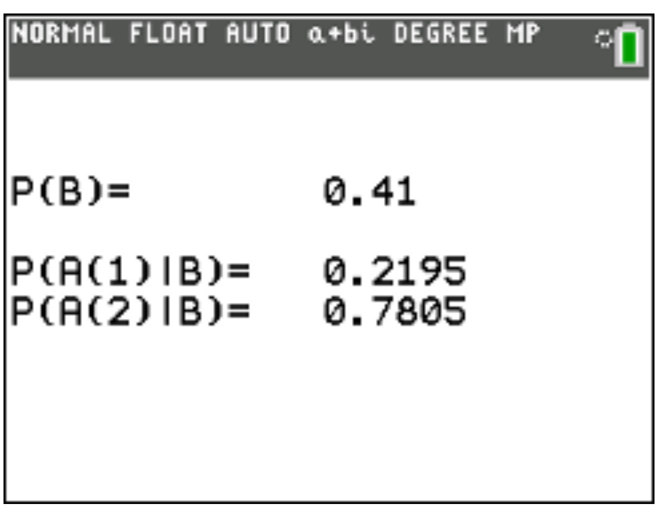
You can now press 4 to do a new problem.



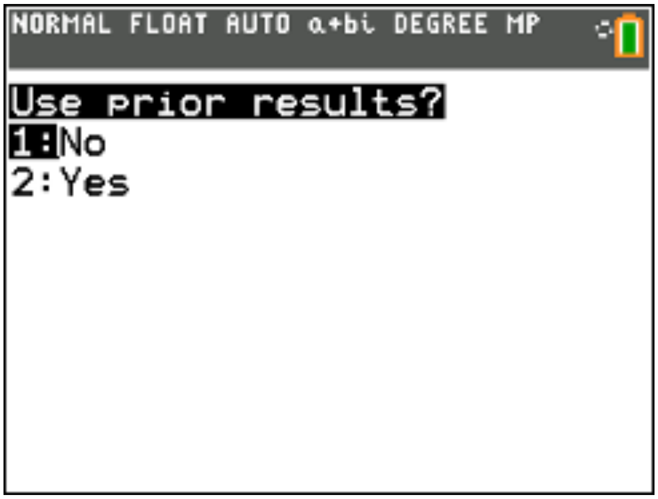


But first you need to decide if the problem is to be actually new or a continuation of the current problem. Choose NO and I'll show you how to do a problem that handles more that one test or condition.

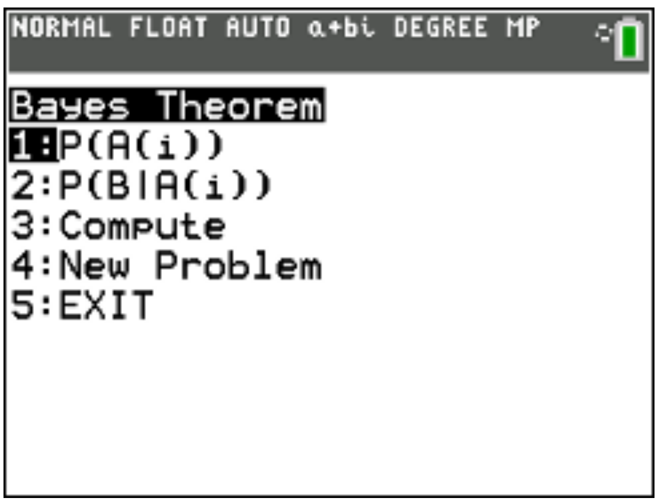
Assume a patient is believed to have one of two diseases, D1 and D2. P(D1) = 0.60 and P(D2) = 0.40. Suppose it is determined he has symptom 1. The conditional probabilities of the symptom showing up given D1 or D2 are: P(S1|D1) = 0.15 and P(S1|D2) =.80. What are the probabilities of him having either disease?



The revised probability of having disease 1 is 0.2195 and disease 2 is 0.7805. But suppose the doctor determines the patient has symptom 2. Press enter and then press 4 for a new problem.

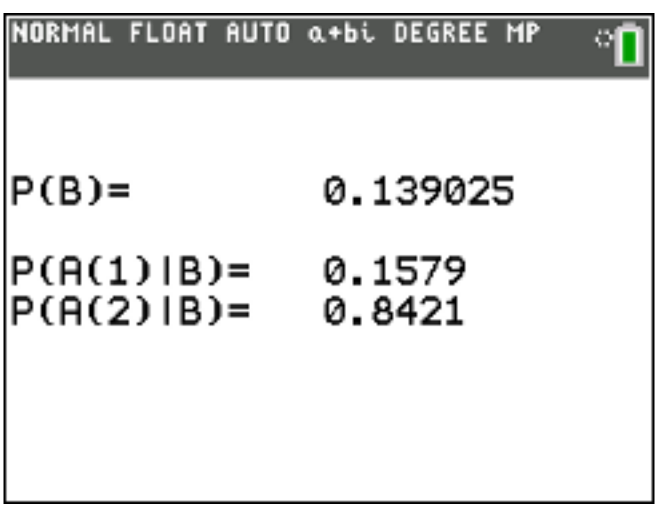


But now press 2 YES to use the prior results.



You are back to the main menu. The conditional probabilities of having symptom 2 given the two diseases are: P(S2|D1) = 0.10 and P(S2|D2) = 0.15.

Now press 2 to enter these conditional probabilities and then compute the new revised probabilities of each disease.



This is what your results should be. The probability of disease 1 given symptoms S1 and S2 are 0.1579 and of disease 2 is 0.8421.

There are two conditions that are tested for that will produce an error message. They are 1) the sum of the P(a(i))s are not equal to 1 and 2) the number of P(A)s is not equal to the number of P(B|A)s.

The joint probabilities of A and B, P(A and B) are in List 3. The results of a calculation are in List 4.