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Problem Statement :-
Write a program to calculate harmonic mean (f-measure) and E-measure for above example.

Objectives :-
1) To evaluate the rebrieval performance of IR
2) To understand importance of harmonic mean & E-measure in IR
3) To study indexing structures for IR

Theory :-
(F-Score / F-measure)
F_1 score considers both precision & recall
It is harmonic mean of the precision & recall.
F_1 Score is best if there is some sort of balance bet° Precision (P) & recall (r) in the system.
For example ;

$$F_1 = 2 \times \frac{\text{Precision} \times \text{recall}}{\text{Precision} + \text{recall}}$$

IR Systems can be measured with two metrics precision and recall, thus precision and recall have been extensively used to evaluate the rebrieval performance of IR systems or algorithms.

Alternative measures :- The harmonic mean / F measure.
The F-measure is also a single measure that combines recall & precision.

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Where;
r(j) is the recall at the j^{th} position in the ranking
P(j) is the precision at the j^{th} position in the ranking.
F(j) is the harmonic mean at the j^{th} position in the ranking

Alternative measures - E measure.
E-measure was proposed by van Rijesbern which combines recall & precision. user is allowed to specify whether he is more interested in recall or in precision
E-measure is defined as

$$E(j) = 1 - \frac{1 + b^2}{\frac{b^2}{r(j)} + \frac{1}{P(j)}}$$

where
r(j) is the recall at the j^{th} position in the ranking
P(j) is the precision at the j^{th} position in the ranking.
$b \geq 0$ is a user specified parameter.
~~b=0~~ E(j) is the user specified parameter.

If $b=1$, E(j) measure works as complement of the Harmonic mean F(j). If $b>1$ indicates that the user is more interested in precision than in recall. if $b<1$ indicates that user is more interested in recall than in precision. Notice that setting $b=1$ in the formula of the E-measure yields $F(j) = 1 - E(j)$.

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To Calculate the Harmonic mean (F-measure) and E-measure in java, we use to focus on the definitions

1) Precision = $\frac{\text{True Positive (TP)}}{\text{True Positive (TP)} + \text{False Positive (FP)}}$

2) Recall = $\frac{\text{True Positive (TP)}}{\text{True positive (TP)} + \text{False Negative}}$

formulas :-

F-measure :- $F_1 = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$

E-measure :- $E = 1 - \frac{1}{\alpha \frac{1}{\text{Precision}} + (1-\alpha) \frac{1}{\text{Recall}}}$

Conclusion :-

Implementation is concluded by executing a program to calculate (F-measure) and E-measure for sample input used in above example.