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Task 1

Subtask 1

$$w_{t,d} = (1 + \log tf_{t,d}) * \log \frac{N}{df_t}$$

- $w_{pens,d_1} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$
- w_{pens,d_2} = not in the doc
- w_{pens,d_3} = not in the doc
- $w_{write,d_1} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{write,d_2} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{write,d_3} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{on,d_1} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{on,d_2} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{on,d_3} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{paper,d_1} = (1 + \log 2) * \log \frac{3}{3} = 0$
- w_{paper,d_2} = not in the doc
- $w_{paper,d_3} = (1 + \log 1) * \log \frac{3}{3} = 0$
- $w_{pencils,d_1}$ = not in the doc
- $w_{pencils,d_2} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$
- $w_{pencils,d_3}$ = not in the doc
- $w_{envelope,d_1}$ = not in the doc
- $w_{envelope,d_2} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$
- $w_{envelope,d_3}$ = not in the doc
- $w_{ballpens,d_1}$ = not in the doc
- $w_{ballpens,d_2}$ = not in the doc
- $w_{ballpens,d_3} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$

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Terms	d_1	d_2	d_3
pens	1.1	0.0	0.0
write	0.0	0.0	0.0
on	0.0	0.0	0.0
paper	0.0	0.0	0.0
pencils	0.0	1.1	0.0
envelope	0.0	1.1	0.0
ballpens	0.0	0.0	1.1

$\overrightarrow{d_1} = (1.1, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0)$
$\overrightarrow{d_2} = (0.0, 0.0, 0.0, 0.0, 1.1, 1.1, 0.0)$
$\overrightarrow{d_3} = (0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1.1)$

Subtask 2

$w_{ballpens,q} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$
$w_{envelope,q} = (1 + \log 1) * \log \frac{3}{1} \approx 1,1$

$\overrightarrow{q} = (0.0, 0.0, 0.0, 0.0, 0.0, 1.1, 1.1)$

$SIM(\overrightarrow{q}, \overrightarrow{d_1}) = \frac{\overrightarrow{q} * \overrightarrow{d_1}}{|\overrightarrow{q}| * |\overrightarrow{d_1}|} = 0$
$SIM(\overrightarrow{q}, \overrightarrow{d_2}) = \frac{\overrightarrow{q} * \overrightarrow{d_2}}{|\overrightarrow{q}| * |\overrightarrow{d_2}|} = \frac{1.21}{49} \approx 0.025$
$SIM(\overrightarrow{q}, \overrightarrow{d_3}) = \frac{\overrightarrow{q} * \overrightarrow{d_3}}{|\overrightarrow{q}| * |\overrightarrow{d_3}|} = \frac{1.21}{49} \approx 0.025$

Rank	**Doc**	**SIM**
1	2	0.025
1	3	0.025
2	1	0

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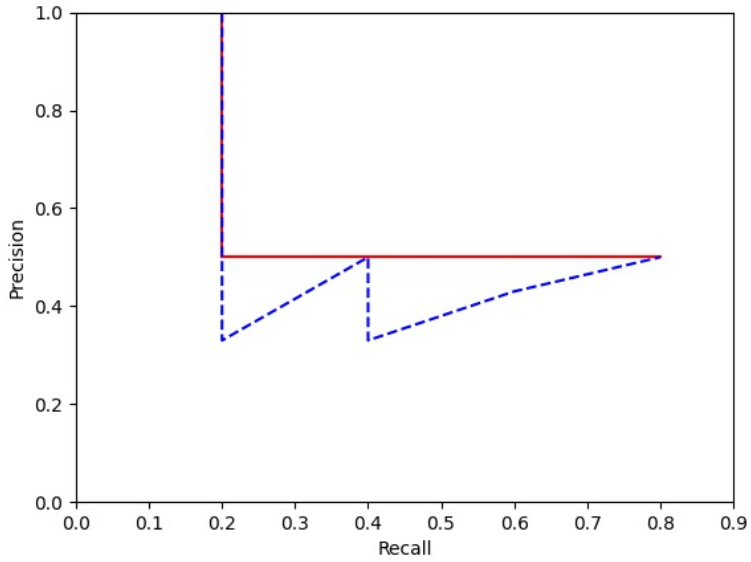
Task 3

- $Precision = \frac{TPs}{TPs+FPs}$
- $Recall = \frac{TPs}{TPs+FNs}$

k	Result Set	Precision	Recall
1	127	1.0	0.2
2	127, 9	0.5	0.2
3	127, 9, 10	0.33	0.2
4	127, 9, 10, 2	0.5	0.4
5	127, 9, 10, 2, 35	0.4	0.4
6	127, 9, 10, 2, 35, 32	0.33	0.4
7	127, 9, 10, 2, 35, 32, 41	0.43	0.6
8	127, 9, 10, 2, 35, 32, 41, 64	0.5	0.8



Task 4

An advantage of using IDF over stop word list is that you don't have a fixed set of words that maybe must be expanded in the future. Expanding a stop word list will change all the weights as a consequence. Due to the Zipf's law if a term is contained in all the documents is most likely to be a stop word. If the IDF value of a term is 0(occurs in all documents) than will have the same effects as if it was included in the stop word lists.
Advantage of using stops words lists are that we could prevent the calculation of the IDF for stops and we can be more precise not including words that maybe occurs in every documents but aren't stops.