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Q1: 3h

Q2:

(a) $S = \sum_{n=0}^{N-1} x[n]y[n] = \sum_{n=0}^{N-1} |x|^2 = E_x$

(b) When $y[n] = ax[n]$,

$$c1 = \sum_{n=0}^{N-1} x[n] \times ax[n] = a \sum_{n=0}^{N-1} |x|^2 = aE_x$$

$$c2 = \frac{a \sum_{n=0}^{N-1} |x|^2}{\sqrt{\sum_{n=0}^{N-1} |x|^2} \times \sqrt{\sum_{n=0}^{N-1} |ax|^2}} = 1$$

When $y[n] = -cx[n]$,

$$c2 = \sum_{n=0}^{N-1} x[n] \times (-c)x[n] = (-c) \sum_{n=0}^{N-1} |x|^2 = -cE_x$$

$$c2 = \frac{-c \sum_{n=0}^{N-1} |x|^2}{\sqrt{\sum_{n=0}^{N-1} |x|^2} \times \sqrt{\sum_{n=0}^{N-1} |(-c)x|^2}} = \frac{-c}{|c|}$$

If $c > 0$, $c2 = -1$;

If $c < 0$, $c2 = 1$.

(c) If $x[n]=0$ or $y[n]=0$, $x[n]y[n]=0$. We can get $c1=1$ only if both $x[n]=1$ and $y[n]=1$, so $c1$ is the count of all locations where 1 is found in both $x[n]$ and $y[n]$.

(d) As for $y_1[n]$, $c1 = 1 + 1 = 2$, $c2 = \frac{2}{\sqrt{2} \times \sqrt{2}} = 1$

As for $y_2[n]$, $c1 = 1$, $c2 = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

As for $y_3[n]$, $c1 = 1 + 1 = 2$, $c2 = \frac{2}{\sqrt{2} \times \sqrt{3}} = \frac{\sqrt{6}}{3}$

As for $y_4[n]$, $c1 = 1$, $c2 = \frac{1}{\sqrt{2} \times \sqrt{2}} = \frac{1}{2}$

(e) $C1$ seems to be computed more easily which sums up all the $x[n]y[n]$, and the maximum value corresponds to the most similar ones, but it does not consider the length of $x[n]$ and $y[n]$. It cannot present that $x[n]$ and $y[n]$ are equal to 1 in the same points. As for $c2$, even though the equation is complex, it considers the length of $x[n]$ and $y[n]$. Like standard regression coefficient, $c2$ consider the influences of $x[n]$ and $y[n]$ themselves, so it is more reliable.

Q3:

(b)

' [ANGRY WIZARD] (An angry wizard stands defiantly in the center of the hall. [A scrap of parchment sticks out from a pocket of his robe.]'

' [ANGRY WIZARD] (An angry wizard stands defiantly in the center of the hall. [A scrap of parchment sticks out from a pocket of his robe.]'

C1=4 c2=0.4020

(c)

'You are at the top of the Great Canyon on its west {south} wall. From here there is a marvelous view of the canyon and parts of the Frigid River upstream. Across the canyon, the walls of the White Cliffs join the mighty ramparts of the Flathead Mountains to the east {White Cliffs still appear to loom far above}. Following the Canyon upstream to the north and northwest, Aragain Falls may be seen, complete with rainbow. The mighty Frigid River flows out from a great dark cavern. {+Unfortunately, my vision is better than average and I can discern the top of the Flood Control Dam #3 far to the distant north.} To the west and south can be seen an immense forest, stretching for miles around. A path leads northwest. It is possible to climb down into the canyon from here.'

' [ANGRY WIZARD] (An angry wizard stands defiantly in the center of the hall. [A scrap of parchment sticks out from a pocket of his robe.]'

C1=20 c2=0.5222

(d)

No, the results from b and c are different. C2 seems more reliable. C1 is to sum up all the $x[n]*y[n]$ ($x[n]=1$, meanwhile, $y[n]=1$), and when c1 is the maximum value, the output result is defined as the one which best matches the search term. In (c), the search term is ' the angry wizard resemble a dragon'. The output sentence is so long which contains many words 'the', so the results of corresponding row in counts multiplying the return matrix can be maximum. However, these two sentences are not similar. C2 divides the length of x and y, so the c2 results exclude the influences of $x[n]$ and $y[n]$ themselves. Therefore, c2 seems more standard.

(e)

My UFID: 64118211

```

c1 = 0;
c2 = 0;
for r = 1:4436
    incount(r) = sum(strcmp(WORDS,vocabulary(1,r)));
end
for q = 1:1734
    text_1 = similarc1(counts(q,:),incount)
    text_2 = similarc2(counts(q,:),incount)
    if text_1 > c1
        c1 = text_1;
        q1 = q;
    end
    if text_2 > c2
        c2 = text_2;
        q2 = q;
    end
end
output1=documents(q1);
output2=documents(q2);
disp(c1);
disp(c2);
disp(output1);
disp(output2);

```

WORDS										
1x10 cell										
	1	2	3	4	5	6	7	8	9	10
1	firmly	stretch	benches	doubtful	stole	none	haven	collapsing	shape	represent...
2										

RESULT:

'This is the southern end of a formal garden. Hedges hide the cavern walls and mosses provide dim illumination. Fantastically shaped hedges and bushes are arrayed with geometric precision. They have not recently been clipped, but you can discern creatures in the shapes of the bushes: There is a dragon, a unicorn, a great serpent, a huge misshapen dog, and several human figures. On the west side of the garden the path leads through a rose arbor into a tunnel.'

'FOX / fox stole'

C1=3 c2=0.1414