

資料結構 Homework3

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目的:

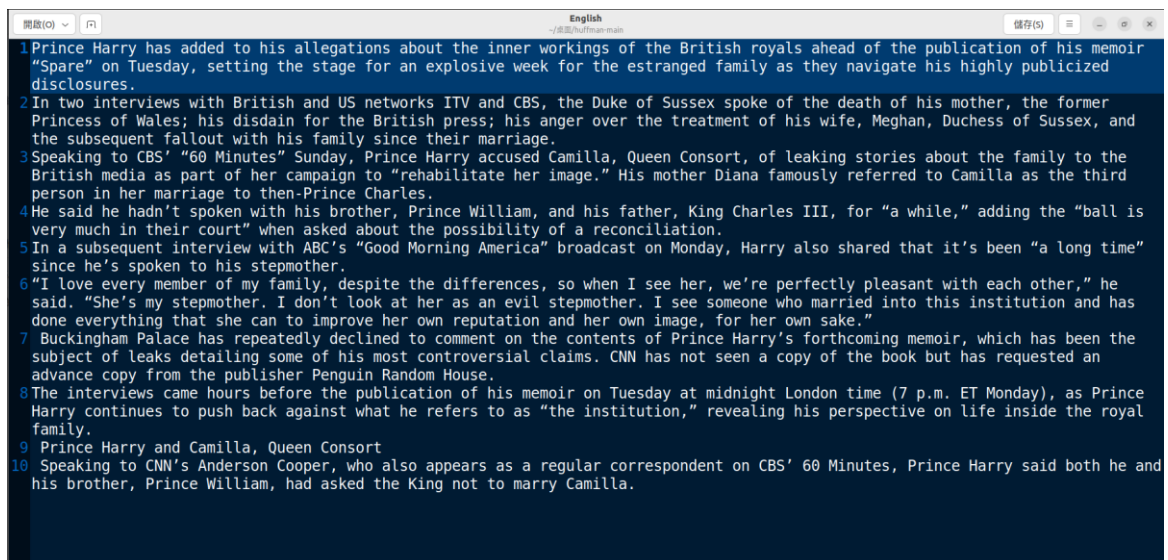
比較 Huffman coding 和 Arithmetic coding 的差異，使用 github 上的開原程式進行測試。兩支程式均會輸出 encoding 和 decoding 過的檔案。

編譯與執行結果:

Huffman coding:

```
brandon@brandon-VirtualBox:~/桌面/huffman-main$ make
make: 對「all」無需做任何事。
brandon@brandon-VirtualBox:~/桌面/huffman-main$ ./huffcode -i English -o encode -c
Huffman Encoding takes 0.000287 s
brandon@brandon-VirtualBox:~/桌面/huffman-main$ ./huffcode -i encode -o decode -d
Huffman Decoding takes 0.000245 s
brandon@brandon-VirtualBox:~/桌面/huffman-main$
```

輸出檔案:



1 Prince Harry has added to his allegations about the inner workings of the British royals ahead of the publication of his memoir "Spare" on Tuesday, setting the stage for an explosive week for the estranged family as they navigate his highly publicized disclosures.

2 In two interviews with British and US networks ITV and CBS, the Duke of Sussex spoke of the death of his mother, the former Princess of Wales; his disdain for the British press; his anger over the treatment of his wife, Meghan, Duchess of Sussex, and the subsequent fallout with his family since their marriage.

3 Speaking to CBS' "60 Minutes" Sunday, Prince Harry accused Camilla, Queen Consort, of leaking stories about the family to the British media as part of her campaign to "rehabilitate her image." His mother Diana famously referred to Camilla as the third person in her marriage to then-Prince Charles.

4 He said he hadn't spoken with his brother, Prince William, and his father, King Charles III, for "a while," adding the "ball is very much in their court" when asked about the possibility of a reconciliation.

5 In a subsequent interview with ABC's "Good Morning America" broadcast on Monday, Harry also shared that it's been "a long time" since he's spoken to his stepmother.

6 "I love every member of my family, despite the differences, so when I see her, we're perfectly pleasant with each other," he said. "She's my stepmother. I don't look at her as an evil stepmother. I see someone who married into this institution and has done everything that she can to improve her own reputation and her own image, for her own sake."

7 Buckingham Palace has repeatedly declined to comment on the contents of Prince Harry's forthcoming memoir, which has been the subject of leaks detailing some of his most controversial claims. CNN has not seen a copy of the book but has requested an advance copy from the publisher Penguin Random House.

8 The interviews came hours before the publication of his memoir on Tuesday at midnight London time (7 p.m. ET Monday), as Prince Harry continues to push back against what he refers to as "the institution," revealing his perspective on life inside the royal family.

9 Prince Harry and Camilla, Queen Consort

10 Speaking to CNN's Anderson Cooper, who also appears as a regular correspondent on CBS' 60 Minutes, Prince Harry said both he and his brother, Prince William, had asked the King not to marry Camilla.

Arithmetic coding:

```
brandon@brandon-VirtualBox:~/桌面/arcd-master/examples$ gcc -o arcd arcd_stream.c arcd.c arcd.h adaptive_model.h adaptive_model.c
arcd.h:1:9: warning: #pragma once in main file
    1 | #pragma once
      |           ^~~~~
adaptive_model.h:1:9: warning: #pragma once in main file
    1 | #pragma once
      |           ^~~~~
brandon@brandon-VirtualBox:~/桌面/arcd-master/examples$ ./arcd -e <short | tee encode
dKoooZZo{ooOonpLoozoo
Arithmetic Encoding takes 0.000055 s
brandon@brandon-VirtualBox:~/桌面/arcd-master/examples$ ./arcd -d <encode | tee decode
asdfghjklpoiuytrewqzxcvbnm,.
Arithmetic Decoding takes 0.000040 s
brandon@brandon-VirtualBox:~/桌面/arcd-master/examples$
```

實驗結果與分析

這次的實驗我比較了不同情況下 Huffman coding 和 Arithmetic coding 的效能差異，我比較了不同大小的檔案、不同符號豐富度的檔案、不同語言但相同長度的檔案

大小:

由實驗結果可以發現，當檔案很小時，兩種算法的效能差不多，但當檔案越來越大時，就可以發現 Huffman coding 在 encode 和 decode 花的時間都比 Arithmetic coding 少很多，另外 Huffman coding decode 的時間都比 encode 的時間長，而 Arithmetic coding 的結果正好相反。

		Huffman (s)	Arithmetic (s)
Short text	encode	0.000086	0.000055
	decode	0.000026	0.000040
Medium text	encode	0.000160	0.000628
	decode	0.000095	0.001002
Long text	encode	0.001066	0.008542
	decode	0.000932	0.009096

符號豐富度:

Arithmetic coding 處理不同符號豐富度的檔案花的時間都差不多，而 Huffman coding 雖然 encoding 的時間差不多，但如果符號較為單一，decode 的速度會。

		Huffman (s)	Arithmetic (s)
Single symbol	encode	0.000124	0.001536
	decode	0.000049	0.002193
Various symbol	encode	0.000151	0.002145
	decode	0.000210	0.002454

不同語言:

由實驗結果可以看出，Huffman coding 和 Arithmetic coding 在處理不同語言時速度沒有太大差異，一樣是 Huffman coding 處理起來比較有效率。

		Huffman (s)	Arithmetic (s)
Chinese	encode	0.000434	0.001297
	decode	0.000287	0.002902
English	encode	0.000378	0.001425
	decode	0.000191	0.001582