

# HW 5

## Due: Apr 18

CS442: Great Insights in Computer Science  
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## 1. Parallel Processing

How many “processors” can usefully work on each of these tasks (1, 2, 3, or no bound)?

- i. cleaning up after a party
- ii. writing a sonet
- iii. collecting firewood
- iv. writing thank you notes after a big wedding
- v. grocery shopping

## 2. Huffman Hawaiian

- Hawaiian has fewer letters than English. I copied a 1513-character passage from an online book (ignoring accents and punctuation) and found only 15 unique characters with the following frequencies:

389	<s>	108	i	61	h	6	w
321	a	102	e	59	n	4	<b>
123	o	82	l	53	m	2	v
113	k	67	u	23	p		

## Continued

- How many bits per character do you need for this example if the codes for *all* characters have the same number of bits?
- In the code below, write “mele kalikimaka”.

001	<s>	101	i	11100	h	111101	w
010	a	110	e	111010	n	111110	<b>
011	o	0001	l	111011	m	111111	v
100	k	0000	u	111100	p		

## Continued

iii. Using the code above, decode:  
010000101111100010.

iv. How many bits per character does it take to encode the 4 paragraph example using this code?

## 3. Machine Learning

Think of an example that supervised machine learning could be applied to (like the “graduate college” example).

- i. What are the features?
- ii. How could you get labels for the examples?
- iii. Do you think it would be linearly separable?

## 4. Paternity Test

- In uniform crossover, two bits strings are combined to produce an “offspring” bitstring. (See the “mate” code from the GA lecture.) What set of fathers could have helped produced the given child?
- Mom: 00000101
- Child: 01111100

## Extra Credit

- The remaining problems require a bit more thought!
- Try these for fun.

## 5. Optimal Encoding

- Returning to the Hawaiian example, find an optimal code using the Huffman coding algorithm from class.
- How many bits per character does your code take for the 4-paragraph example?

<s>	i	h	w
a	e	n	<b>
o	l	m	v
k	u	p	

## 6. Logical Net

Find a way to set the weights of a neural network with two inputs “a” and “b” (and an “always 1” input) so that it computes “a and not b”.

## 7. Frosty RL

- How is a robot that is learning from experience like the traveler in Frost's poem "The Road Less Traveled"?