Problem Set #3

Quiz, 5 questions

1 point

1.
Consider an alphabet with five letters, $\{a, b, c, d, e\}$, and suppose we know the frequencies $f_a = 0.32$, $f_b = 0.25$, $f_c = 0.2$, $f_d = 0.18$, and $f_e = 0.05$. What is the expected number of bits used by Huffman's coding scheme to encode a 1000-letter document?

- 2230
- 2400
- 3000
- 3450

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1 point

2.
Under a Huffman encoding of n symbols, how long (in terms of number of bits) can a codeword possibly be?

- n
- $\log_2 n$
- $n-1$
- $\ln n$

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1 point

3.

Which of the following statements holds for Huffman's coding scheme?

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- If the most frequent letter has frequency less than 0.33, then all letters will be coded with at least two bits.
- A letter with frequency at least 0.5 might get encoded with two or more bits.
- If a letter's frequency is at least 0.4, then the letter will certainly be coded with only one bit.
- If the most frequent letter has frequency less than 0.5, then all letters will be coded with more than one bit.

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1 point

4.

Which of the following is true for our dynamic programming algorithm for computing a maximum-weight independent set of a path graph? (Assume there are no ties.)

- The algorithm always selects the maximum-weight vertex.
- If a vertex is excluded from the optimal solution of two consecutive subproblems, then it is excluded from the optimal solutions of all bigger subproblems.
- As long as the input graph has at least two vertices, the algorithm never selects the minimum-weight vertex.
- If a vertex is excluded from the optimal solution of a subproblem, then it is excluded from the optimal solutions of all bigger subproblems.

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1 point

5.

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Recall our dynamic programming algorithm for computing the maximum-weight independent set of a path graph. Consider the following proposed extension to more general graphs. Consider an undirected graph with positive vertex weights. For a vertex v, obtain the graph $G'(v)$ by deleting v and its incident edges from G, and obtain the graph $G''(v)$ from G by deleting v, its neighbors, and all of the corresponding incident edges from G. Let $OPT(H)$ denote the value of a maximum-weight independent set of a graph H. Consider the formula $OPT(G) = \max\{OPT(G'(v)), w_v + OPT(G''(v))\}$, where v is an arbitrary vertex of G of weight w_v. Which of the following statements is true?

- The formula is always correct in trees, but does not lead to an efficient dynamic programming algorithm.
- The formula is always correct in trees, and it leads to an efficient dynamic programming algorithm.
- The formula is correct in path graphs but is not always correct in trees.
- The formula is always correct in general graphs, and it leads to an efficient dynamic programming algorithm.

I, **David Bai**, understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account.

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