

University of Nevada, Las Vegas Computer Science 477/677 Fall 2026

Examination February 11, 2026

Name: \_\_\_\_\_

No books, notes, scratch paper, or calculators. Use pen or pencil, any color. Use the rest of this page and the backs of the pages for scratch paper. If you need more scratch paper, it will be provided. If you want anything on extra pages to be graded, staple those pages to your test and write, "Please grade this page."

The entire examination is 280 points.

1. True or False.

- (a) [5 points] \_\_\_\_\_ If there are 100 data items and 10000 possible hash values, collisions are so unlikely that you can, in practice, assume that they won't happen.
- (b) [5 points] \_\_\_\_\_ Open hashing uses open addressing.
- (c) [5 points] \_\_\_\_\_ Open hashing uses probe sequences.
- (d) [5 points] \_\_\_\_\_ False overflow for a queue can be avoided by implementing the queue as a circular list.
- (e) [5 points] \_\_\_\_\_ If a stack is implemented as a linked list, the head of the linked list should hold the top item of the stack.
- (f) [5 points] \_\_\_\_\_ Heapsort is a dynamic programming algorithm.
- (g) [5 points] \_\_\_\_\_ A hash function should appear to be random, but cannot actually be random.
- (h) [10 points] \_\_\_\_\_ The worst case time complexity of quicksort is  $O(n \log n)$

2. Fill in the blanks.

- (i) [5 points] Any comparison-based sorting algorithm on a file of size  $n$  executes \_\_\_\_\_ comparisons. (Use  $\Omega$  notation.)
- (ii) [15 points] The asymptotic time complexity to find an item in an ordered array of length  $n$  is \_\_\_\_\_ using the divide and conquer algorithm \_\_\_\_\_.
- (iii) [10 points] In a priority queue, each item in the structure represents an \_\_\_\_\_.
- (iv) [5 points] The height of a binary tree with 20 leaves must be at least \_\_\_\_\_. Exact answer please: no partial credit.

3. For each of the code fragments below, find the asymptotic time complexity in terms of  $n$ .

(a) [5 points]

```
for(float x = n; x > 1; x = x/2)
```

(b) [5 points]

```
for(int i = 0; i*i < n; i++)
```

(c) [10 points] `for(float x = n; x > 2.0; x = sqrt(x))`

(d) [5 points]

```
for(int i = 1; i < n; i=2*i)
```

(e) [5 points]

```
for(int i = n; i > 1; i=i/2)
```

(f) [10 points]

```
for(int i = n; i > 1; i--)  
  for(int j = i; j > 1; j = j/2)
```

(g) [10 points]

```
for(int i = n; i > 1; i--)  
  for(int j = n; j > i; j = j/2)
```

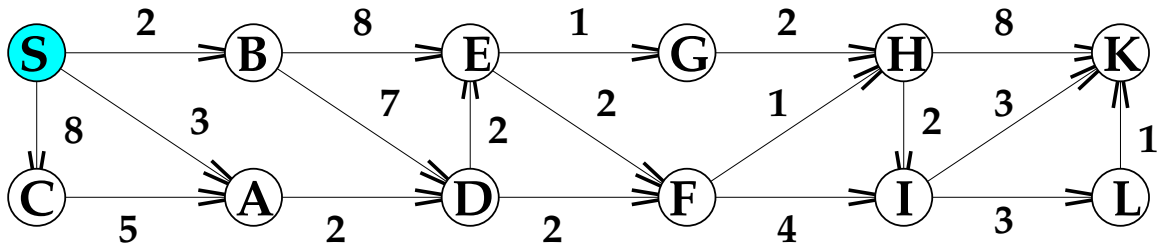
(h) [10 points]

```
for(int i = 2; i < n; i=i*i)
```

4. [20 points] Write pseudocode for the Floyd-Warshall algorithm. Let  $W_{i,j}$  be the initial weight of the arc from  $i$  to  $j$ ,  $\infty$  if there is no arc. Let  $V_{i,j}$  be the minimum weight of any path from  $i$  to  $j$ , and  $back_{i,j}$  the backpointer.

5. [20 points] Write Pseudocode for the Bellman-Ford algorithm. Be sure to use the shortcut.

6. [20 points] Walk through Dijkstra's algorithm for the following directed graph, where  $S$  is the start vertex.



	S	A	B	C	D	E	F	G	H	I	K	L
V	0											
back												

7. Sort the following array using heapsort. Add extra rows if needed.

A	M	G	X	E	W

8. [10 points] Execute mergesort for the following array.

QWIKRYZQH ZDB

9. [10 points] Execute polyphase mergesort for the following array.

QWIKRYZQH ZDB

10. [20 points]

There is a row of  $n$  coins,  $c_1, c_2, \dots, c_n$ . Each coin has a positive value,  $v_1, \dots, v_n$ . Write an algorithm which finds the maximum total value of any set of those coins which contains no three coins which are consecutive in the original row.

11. [40 points] Write pseudocode for quicksort. Assume that no two items are equal.