

Today: {merge, quick, heap, ...}sort. §§ 8.5, 8.6, 21.5, 21.6; Reynolds's paper.¹

Next class: Catch-up; review. **Check newsgroup for reading.**

Reminders: Midterm exam. Newsgroup is required reading (and writing); use to advantage.

1. Write your group members' names below. Underline your name.

2. Depict the action of *in-place heapsort* on the following array. Depict the *state of the array*, and the *implicit binary heap it encodes* (in the usual graphical form), after each *deleteMin* operation.

66 70 99 43 58 77 41 74 81 70

¹Samuel W. Reynolds, "A Generalized Polyphase Merge Algorithm," *Communications of the ACM* 4/8 (1961).

3. Consider an external storage device with a *page size* of 16 bytes (artificially low for illustration). Depict an aligned layout of the following array of 32-bit integers in such a device. How many page accesses are needed to access (1) all elements and (2) every fourth element of the array?

83 10 80 85 88 7 93 25 63 46 9 14 87 97 49 82

4. Depict the action of *heap sort* on the array of Question 3. Determine the exact number of page accesses made in the first three iteration of the outer loop. What is the total number of of page accesses?

83 10 80 85 88 7 93 25 63 46 9 14 87 97 49 82

[additional space for answering the earlier question]

5. Depict the action of 2-way merge sort on the data of Question 4. Determine the exact number of page accesses for the first three merges, as well as the total number of page accesses.

83 10 80 85 88 7 93 25 63 46 9 14 87 97 49 82

6. Repeat Question 5 for 4-way merge sort.

7. ★ How many page access are made by a k -way merge sort operating on nm items in external memory of page size m (as a function of k , m , and n)?

8. Fill in the blank entries in the following tables, indicating the number of runs on each of the five tapes used in a *polyphase merge-sort of order 4*. Row n of each table summarizes the distribution of runs on the tapes immediately following the n th merge, with the 0th row summarizing the initial distribution of runs (before any merges). Leave space in each cell to answer Question 9.

m	# runs on tape				
	1	2	3	4	5
0	8 (1)	8 (1)	7 (1)	7 (1)	0
1					
2					
3					
4					
5					
6					
7					
8					

m	# runs on tape				
	1	2	3	4	5
0	10 (1)	9 (1)	5 (1)	6 (1)	0
1					
2					
3					
4					
5					
6					

