1(a):

In code

1(b):

random array

[71, 81, 98, 34, 39, 11, 21, 33, 5, 99]

Part1(b) sorted array with heap sort

[5, 11, 21, 33, 34, 39, 71, 81, 98, 99]

1(c):

Elapsed time in nanoseconds for merge sort when 4 integers are sorted: 256000

Elapsed time in nanoseconds for heap sort when 4 integers are sorted: 2300

Elapsed time in nanoseconds for merge sort when 64 integers are sorted: 49600

Elapsed time in nanoseconds for heap sort when 64 integers are sorted: 31700

Elapsed time in nanoseconds for merge sort when 256 integers are sorted: 232000

Elapsed time in nanoseconds for heap sort when 256 integers are sorted: 40700

Elapsed time in nanoseconds for merge sort when 1024 integers are sorted: 399800

Elapsed time in nanoseconds for heap sort when 1024 integers are sorted: 168400

Elapsed time in nanoseconds for merge sort when 4096 integers are sorted: 892000

Elapsed time in nanoseconds for heap sort when 4096 integers are sorted: 736500

Elapsed time in nanoseconds for merge sort when 16384 integers are sorted: 3957700

Elapsed time in nanoseconds for heap sort when 16384 integers are sorted: 3353600

Elapsed time in nanoseconds for merge sort when 65536 integers are sorted: 9976300

Elapsed time in nanoseconds for heap sort when 65536 integers are sorted: 7750900

Elapsed time in nanoseconds for merge sort when 262144 integers are sorted: 35190000

Elapsed time in nanoseconds for heap sort when 262144 integers are sorted: 29878600

Elapsed time in nanoseconds for merge sort when 1048576 integers are sorted: 140967800

Elapsed time in nanoseconds for heap sort when 1048576 integers are sorted: 115584200

Elapsed time in nanoseconds for merge sort when 4194304 integers are sorted: 532322800

Elapsed time in nanoseconds for heap sort when 4194304 integers are sorted: 509358100

Elapsed time in nanoseconds for merge sort when 16777216 integers are sorted: 2284611100

Elapsed time in nanoseconds for heap sort when 16777216 integers are sorted: 2159678500

1(d):

295.528 kb

1(e):

727,284 kb