CS 325: Assignment 1

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1. Intersection of $8n^2$ and $64nlog_2n \approx 43.5593$. Insertion sort will beat merge sort at $n >= 44$
2. Table:)
3. **Base Case**(n=2):
   $2lg2 = 2$
   Inductive Step:
   $T(2^{k+1}) = 2^{k+1}lg(2^{k+1})$
   $T(2^{k+1}) = 2^k * 2 * lg(2^k * 2)$
   $T(2^{k+1}) = 2^k * 2 * lg(2^k) * 2lg2$
   $T(2^k * 2) = 2^k * 2 * lg(2^k)$
   $T(2^k) = 2^k * lg(2^k)$
   $T(2^{k+1})$ implies $T(2^k)$
4. Answers:
   (a) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} n^{0.75}/n^{0.5} = \lim_{x\to\infty} n^{0.25} = \infty$
   $f(n) = \Omega(g(n))$
   (b) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} \frac{n}{log^2 n} = \infty$ (L.H. doesn't simplify result)
   $f(n) = \Omega(g(n))$
   (c) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} \frac{log(n)}{log_2 n} = log(2)$ $f(n) = \Theta(g(n))$
   (d) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} \frac{e^n}{2^n} = \infty$ $f(n) = \Omega(g(n))$
   (e) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} \frac{e^n}{2^n} = \infty$ $f(n) = \Omega(g(n))$
   (f) $\lim_{x\to\infty} f(x)/g(x) = \lim_{x\to\infty} \frac{2^n}{2^n-1} = \lim_{x\to\infty} 2^n-(n-1) = 2$ $f(n) = \Theta(g(n))$
   $f(n) = \Omega(g(n))$
5. Algorithm:
   (a) Split array into pairs of consecutive values
   (b) Sort pair elements into local minima maxima (2 arrays): n/2 comparisons

(c) Compare all local minima (associatively) to find global minimum: n/2 comparisons

(d) Compare all local maxima (associatively) to find global maximum: n/2 comparisons

Worst case performance: 1.5n comparisons

Example: A=[9,3,5,10,1,7,12], n=7

(a) (9,3), (5,10), (1,7), (12)

(b) Local Minima: [3,5,1,12], Local Maxima: [9, 10, 7, 12] = 3 comparisons

(c) Global Maximum: 12 = 3 comparisons

(d) Global Minimum: 1 = 3 comparisons

(e) Total number of comparisons: 9. 9/7 = 1.28n comparisons

6. Results:

n (recursive)	**time (recursive)**	**n (iterative)**	**time (iterative)**
a	b	c	d
a	b	c	d

1 Introduction

Here is the text of your introduction.

$$\alpha = \sqrt{\beta} \tag{1}$$

1.1 Subsection Heading Here

Write your subsection text here.

2 Conclusion

Write your conclusion here.