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# HW 1

1) I would prefer live classes on Zoom at scheduled times.

2)
```
Selection_sort(int s = v.size(); s>1; s--) {
    int mi(0);
    for(int i = 1; i<s; i++) {
        if (v[mi] < v[i])
            mi = i;
    }
    swap(v[mi], v[s-1]);
}
```

$\frac{n^2-n}{2} - \frac{2n}{2} + \frac{2}{2}$

The outer loops goes n times
The inner loop goes s times each iteration

$[(n) + (n-1) \ldots + 3 + 2]$
$+ [1 + 2 + \ldots (n-1)]$

$2s = (n+1) + (n+1) \ldots + (n+1)$

$= \frac{(n+n^2)}{2}$ for worst case $V[mi] < V[i]$

$\sum_{s=2}^{n} (1) = \sum_{s=1}^{n-1} (1) = (n-1)$ for number of swaps

3) $n\lg n,\ n,\ 4^{\lg n},\ \sqrt{n},\ \lg(n^2),\ (\lg n)^2$

$$\lim_{n\to\infty} \frac{4^{\lg n}}{n\lg n} = \frac{2x}{\log_2 x + \frac{1}{\ln 2}} = \frac{2\ln(2)x}{\ln(x)+1} = \frac{2\ln(2)}{\frac{1}{x}} = \infty$$

$4^{\lg n}$ faster than $n\lg n$

$$\lim_{n\to\infty} \frac{n\lg n}{n} = \lg n = \infty$$

$n\lg n$ faster than $n$

$$\lim_{n\to\infty} \frac{n}{(\lg n)^2} = \frac{1}{\frac{2\lg n}{\ln(n)2}} = \frac{\lg(n)}{2\lg(2)} = \frac{\ln(2)}{\frac{2}{\ln(2)n}} = \frac{\ln^2(2)n}{2} = \infty$$

$n$ is faster than $(\lg n)^2$

$$\lim_{n\to\infty} \frac{(\lg n)^2}{\lg(n^2)} = \frac{\frac{2\lg(n)}{\ln(2)n}}{\frac{2}{\ln(2)x}} = \lg(n) = \infty$$

$(\lg n)^2$ is faster than $\lg(n^2)$

$$\lim_{n\to\infty} \frac{\lg(n^2)}{\sqrt{n}} = \frac{\frac{2}{\ln(2)n}}{\frac{1}{2\sqrt{n}}} = \frac{4}{\ln(2)\sqrt{n}} = 0$$

$\lg(n^2)$ is slower than $\sqrt{n}$

$$\lim_{n\to\infty} \frac{\sqrt{n}}{(\lg n)^2} = \frac{\frac{1}{2\sqrt{x}}}{\frac{2\lg(x)}{\ln(2)x}} = \frac{\ln(2)\sqrt{n}}{4\lg n} = \frac{\ln^2(2)}{8}\sqrt{x} = \infty$$

$\sqrt{n}$ faster than $(\lg n)^2$

$$\lim_{n\to\infty} \frac{n}{\sqrt{n}} = \infty$$

$n$ is faster than $\sqrt{n}$

Slowest to fastest:

$\lg(n^2)$, $(\lg n)^2$, $\sqrt{n}$, $n$, $n\lg n$, $4^{\lg n}$