Quiz Tues March 5 Section 3.2

$$\sum_{n=7}^{10} (3n+7)$$

$= \underset{(n=7)}{28} + \underset{(n=8)}{31} + \underset{(n=9)}{34} + \underset{(n=10)}{37}$

$= 130$

3.3 Cont'd

Ex: Calculate $\sum_{j=0}^{\infty} 75\left(\frac{3}{5}\right)^j$

$= 75 + 45 + 27 + \ldots$

Geometric Series $r = \frac{45}{75} = \frac{3}{5}$ $a_1 = 75$

$$S_\infty = \frac{a_n}{1-r} \quad \text{if } -1 < r < 1$$

$$= \frac{75}{\left(1-\frac{3}{5}\right)}$$

$$= 187.5$$

Ex: Calculate $\sum_{j=0}^{10} 75\left(\frac{3}{5}\right)^j$

$$= \underset{(j=0)}{75} + \underset{(j=1)}{45} + \dots + \underset{(j=10)}{75\left(\frac{3}{5}\right)^{10}}$$

Geometric $r = \frac{45}{75} = \frac{3}{5}$ $\quad a_1 = 75$

$$S_k = \frac{a_m\left(1-r^k\right)}{1-r}$$

k = # of terms

$= n - m + 1$

$= 10 - 0 + 1$

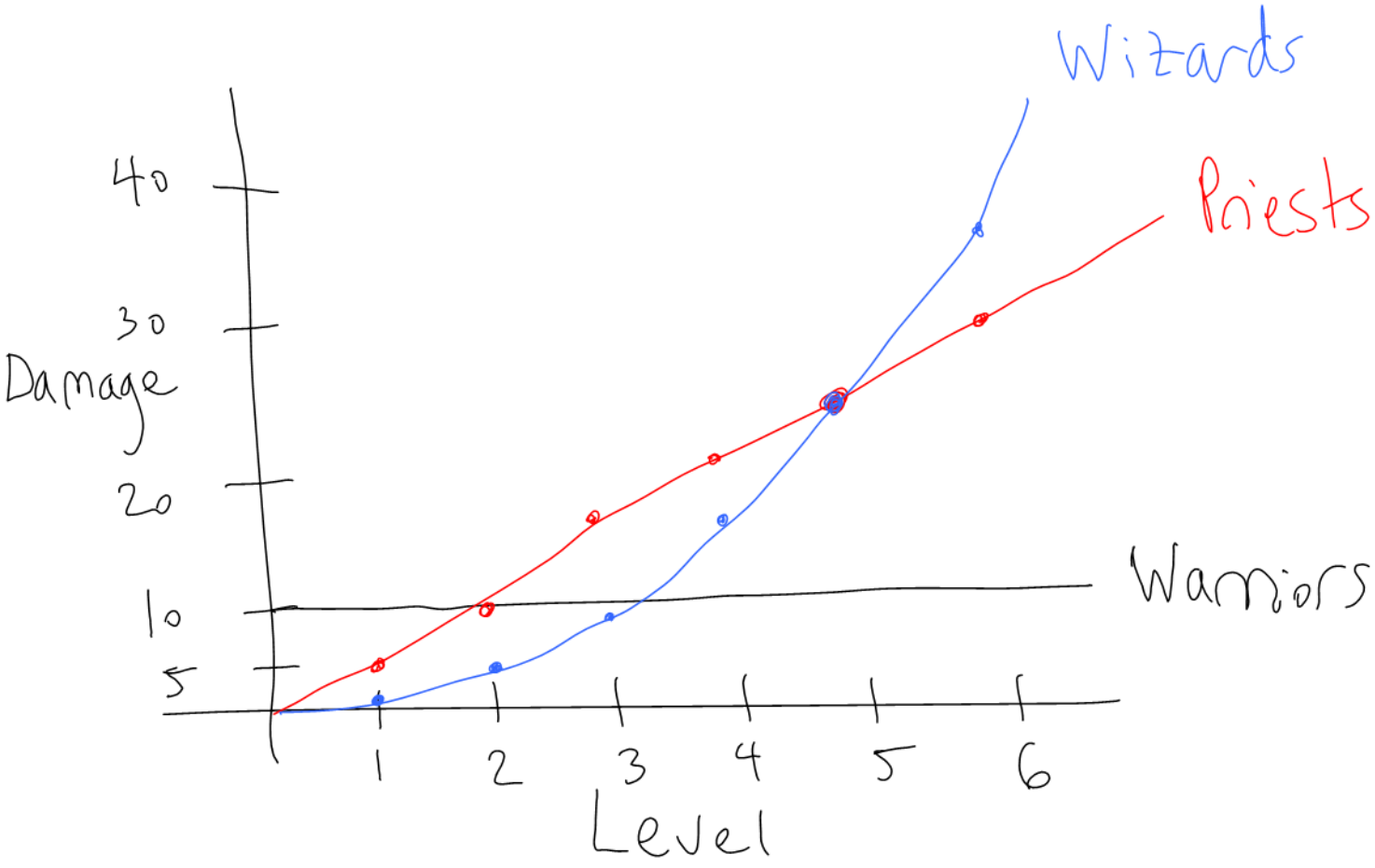
$= 11$

$$S_{11} = \frac{75\left(1-\left(\frac{3}{5}\right)^{11}\right)}{\left(1-\frac{3}{5}\right)}$$

$$\approx 186.82$$

4.1 Rates of Growth and Big O Notation

Ex: In a computer game,
Warriors do 10 points of damage (regardless of level)
Priests do 5 points of damage per level
Wizards do $(\text{level})^2$ points of damage



a) Who does most damage at Level 1?

Warriors

b) Who does most damage at Level 6?

Wizards

c) What level is the breakeven point between Priests and Warriors?

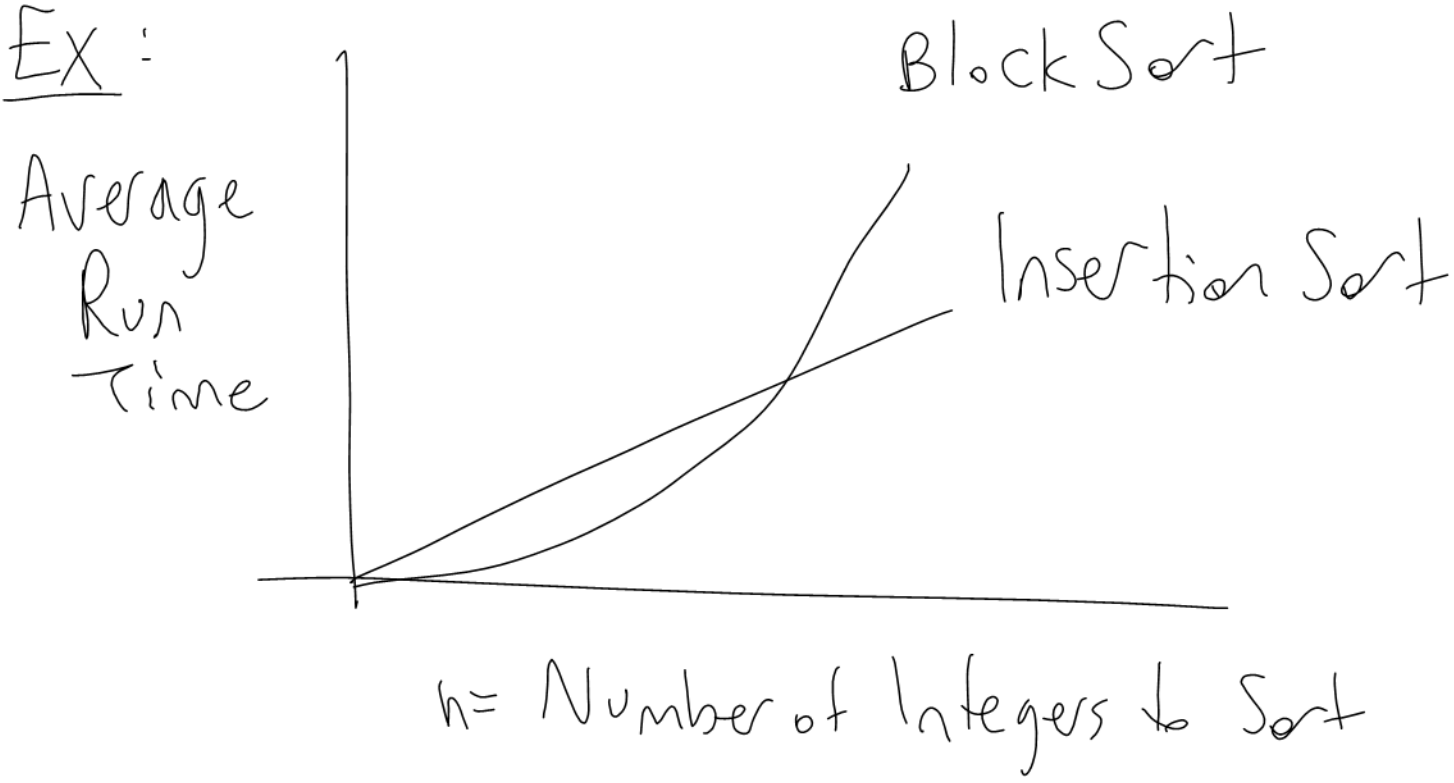
Level 2

Consider a program that sorts integers.

e.g. Input: 19, 2, 10, 7

Output: 2, 7, 10, 19

Ex:



a) Which algorithm performs best for very small values of n?

Best = smaller average run time

Block Sort

b) Which algorithm performs best for very large values of n?

Insertion Sort

In practice, we only care about large values of n.

The <u>dominant term</u> of $3n^2+5n$ is n^2

- Choose highest power of n
- Ignore coefficients

We say that $3n^2+5n$ is $O(n^2)$ or "of order n^2".

Expression	Dominant Term	Order
$4n+6$	n	$O(n)$
$4n$	n	$O(n)$
n	n	$O(n)$
$3n^2$	n^2	$O(n^2)$
n^2	n^2	$O(n^2)$
$4n^2+6n+2$	n^2	$O(n^2)$
3	1	$O(1)$

Let n = input size of an algorithm (also called the number of elements).

The number of operations can be calculated.

Ex: An algorithm has $6n^2+2$ operations.

What is the order of the algorithm?

$O(n^2)$