1. [5 marks] State the order of the following expressions:

a) $5n + 6 \log n$

$O(n)$

b) $7n! + 4(2^n)$

$O(n!)$

c) $6n^2 + 8(2^n)$

$O(2^n)$

d) $9n! + 3n^2$

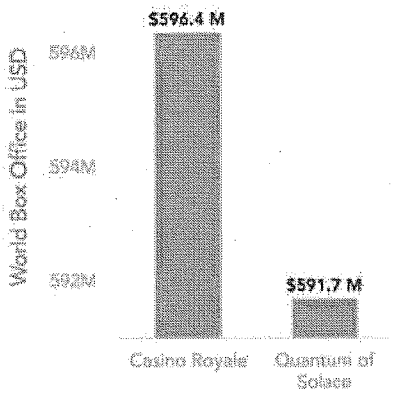
$O(n!)$

e) $4n(2 + 3 \log n)$

$= 8n + 12n \log n$

This is $O(n \log n)$

2. [1 mark] The graph below shows revenue (in US Dollars) for two different movies. State the primary problem with the graph.



The vertical axis does not start at 0.

3. [2 marks] An arithmetic sequence has $a_{18} = 13$ and $a_{41} = -424$. Find d.

$a_n = a_m + (n-m)d$

$n=41$, $m=18$: $a_{41} = a_{18} + 23d$

$a_{41} = -424$, $a_{18} = 13$: $-424 = 13 + 23d$

$-437 = 23d$

$-19 = d$

$\boxed{d = -19}$

4. [2 marks] Find a_{18} for the sequence below. Assume that the first term is called a_1.
$4096, 2048, 1024, \ldots$

Geometric Sequence

$r = \frac{1}{2}$

$a_1 = 4096$

$a_n = a_m r^{n-m}$

$n=18$, $m=1$: $a_{18} = a_1 r^{17}$

$a_{18} = 4096 \left(\frac{1}{2}\right)^{17}$

$a_{18} = 0.03125$ or $\frac{1}{32}$

$\boxed{r = \frac{2048}{4096} = \frac{1}{2}}$

5. [4 marks] Find the sum of the first 20 terms of:

a) $5 + 4.8 + 4.6 + \ldots$

$d = 4.8 - 5 = -0.2$

Arithmetic Series

$d = -0.2$

$a_1 = 5$

k = # of terms $= 20$

$m = 1$, $n = 20$, $k = 20$: $S_k = \frac{k}{2}[2a_m + (n-m)d]$

$S_{20} = \frac{20}{2}[2a_1 + 19d]$

$a_1 = 5$, $d = -0.2$: $S_{20} = \frac{20}{2}[2(5) + 19(-0.2)]$

$S_{20} = 62$

b) $6 + 12 + 24 + \ldots$

$r = \frac{12}{6} = 2$

Geometric Series

$r = 2$

$a_1 = 6$

k = # of terms $= 20$

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

$k = 20$, $m = 1$: $S_{20} = \frac{a_1(1-r^{20})}{1-r}$

$a_1 = 6$, $r = 2$: $S_{20} = \frac{6(1-2^{20})}{(1-2)}$

$S_{20} = 6,291,450$

6. [2 marks] Camosun currently has 12,000 students. Camosun wants to know the ages of all these students. The records of 200 students are randomly selected for analysis.

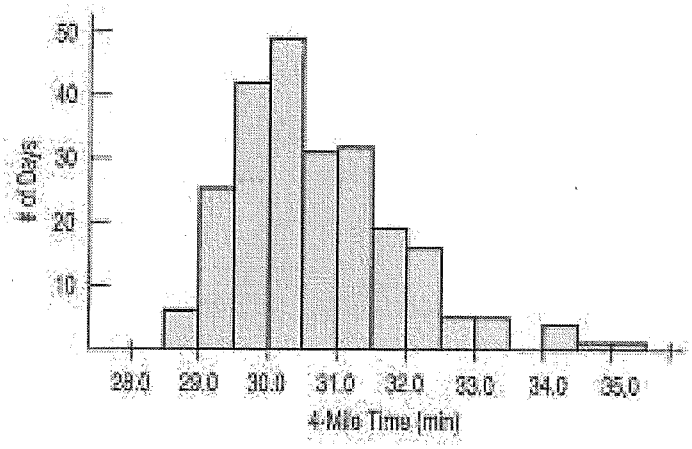
a) How many measurements are in the sample?

200

b) How many measurements are in the population?

12,000

7. [2 marks] The histogram below shows the time (in minutes) someone took to run four miles, with the number of days on the vertical axis.



a) Is the data bimodal, unimodal symmetrical, unimodal skewed left, or unimodal skewed right?

unimodal skewed right

b) State the mode or modes.

The mode is 30.0 - 30.5 minutes.

8. [2 marks] Circle all the following that are smaller than $O(n^2)$:

(O(n)) (O(log n)) O(2^n) (O(n log n)) O(n^2) (O(1)) O($n!$)