Analysis of Algorithms: Results of Exam 1

| number of exams | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

0-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85-89 90-100

The histogram shows the distribution of grades, not including the bonus.

Problem 10

A ternary heap is like a binary heap, but instead of two children, nodes have three children.

(a) How would you represent a ternary heap by an array? What are the expressions for determining the parent and children of a given element?

The following expressions determine the parent and children of element $i$:

$$
\text{PARENT}(i) = \left\lfloor \frac{i + 1}{3} \right\rfloor
$$

$$
\text{LEFT-CHILD}(i) = 3i - 1
$$

$$
\text{MIDDLE-CHILD}(i) = 3i
$$

$$
\text{RIGHT-CHILD}(i) = 3i + 1
$$

(b) What is the height of a ternary heap of $n$ elements in terms of $n$?

The height $h$ of a heap is approximately equal to $\log_3 n$. The exact height is

$$
h = \lceil \log_3 (2n + 1) - 1 \rceil
$$