1 The Role of Algorithm in Computing

1.1 Algorithms

1.1-1
Google Trends requires sorting to give the hoteset searches.

1.1-2
i/o operations, network traffic, etc.

1.1-3
Hash table:
Strengths: very fast ($O(1)$) to access by key
Limitations: To access by value one has to walk through the entire table.

1.1-4
Similarity: both are about finding the shortest path on a graph.
Difference: shortest-path has a known $O(N^2)$ algorithm while traveling-salesman does not.

1.1-5
Only the best will do: You are a TA of your college's algorithm course. And you need to rank the students by their final exam scores.
Appoxiamate solution is good enough: You are a developer working at TAOBAO. And you need to rank the users by their yearly expenses. You don't need to give their exact places. A percentage is good enough.

1.2 Algorithma as a technology

1.2-1
Google Translate requires an algorithm to translate sentences from one language to another. The algorithm takes sentences of some languge as input and output the sentence of target language.

1.2-2
$n \leq 43$

1.2-3
$n = 14$

Problems

1-1

	1 second	1 minute	1 hour	1 day	1 month	1 year	1 century
$\lg n$	2^{1M}	2^{60M}	$2^{3.6B}$	$2^{86.4B}$	2^{2592B}	2^{31536B}	$2^{3153600B}$
$\sqrt{n}$	$(10^6)^2$	$(60M)^2$	$(3.6B)^2$	$(86.4B)^2$	$(2.592T)^2$	$(31.536T)^2$	$(3.1536P)^2$
n	10^6	6×10^7	3.6×10^9	8.64×10^{10}	2.592×10^{12}	3.1536×10^{13}	3.1536×10^{15}
$n \lg n$							
n^2	1K	$\sqrt{60}K$	60K	$\sqrt{24} \times 60K$	$\sqrt{5} \times 720K$	$\sqrt{24 \times 365} \times 60K$	$\sqrt{24 \times 365} \times 600K$
n^3	100	$\sqrt[3]{60} \times 100$	$\sqrt[3]{3600} \times 100$	$\sqrt[3]{400} \times 600$	$\sqrt[3]{12} \times 6K$	$\sqrt[3]{146} \times 6K$	$\sqrt[3]{14600} \times 6K$
2^n	20	$\lg 15 + 22$	$2 \lg 15 + 24$	$\lg 3 + 2 \lg 15 + 27$	$\lg 15 + \lg 3 + 2 \lg 15 + 28$	$\lg 73 + 3 \lg 3 + 3 \lg 5 + 27$	$\lg 73 + 3 \lg 3 + 5 \lg 5 + 29$
$n!$							