Problem 1

Table below gives data, reproduced by permission of the Rand Corporation, from a report on 32 light water reactor (LWR) power plants constructed in the USA. It is required to predict the capital cost involved in the construction of further LWR power plants. The notation used in Table a is explained in Table b. What is the right general form of model to fit?

General Considerations

1. Among the independent variables, it is suggested to make the log-transformation on S, N, T_1 and T_2 due to unit-free parameters whose values can be interpreted in terms of power-law relations between the original variables.
2. Do random variations in cost increase with the value of cost? Should the dependent variable, be transformed?
3. After fitting the model, are there outliers or anomalous observations that need to be isolated?
4. Is it feasible to simplify the model, normally by reducing the number of explanatory variables?
5. The final six lines of data relate to power plants for which there were partial turnkey guarantees and for which it is possible that some manufacturers' subsidies might be hidden in the quoted capital cost. There is some doubt whether these 6 observations distinct from the main body of 26 for "*PT*". How to test whether they form the same group or different groups?
6. What are the limitations on the interpretation and application of the final relation achieved?

Table a. Data on thirty-two LWR power plants in the USA

C	*D*	T_1	T_2	*S*	*PR*	*NE*	*CT*	*BW*	*N*	*PT*
460.05	68.58	14	46	687	0	1	0	0	14	0
452.99	67.33	10	73	1065	0	0	1	0	1	0
443.22	67.33	10	85	1065	1	0	1	0	1	0
652.32	68.00	11	67	1065	0	1	1	0	12	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Table b. Notation for data of Table G.1

C	Cost in dollars $\times 10^{-6}$, adjusted to 1976 base
D	Data construction permit issued
T_1	Time between application for and issue of permit
T_2	Time between issue of operating license and construction permit
S	Power plant net capacity
PR	Prior existence of an LWR on same site (=1)
NE	Plant constructed in north-east region of USA (=1)
CT	Use of cooling tower (=1)
BW	Nuclear steam supply system manufactured by Babcock-Wilcox (=1)
N	Cumulative number of power plants constructed by each architect-engineer
PT	Partial turnkey plant (=1)