1.1)

a) $|N| = 5$

b) Informatik = I, macht = m, Spaß = S, ist = i, super = s

$Pot(N) = 2^N = \{\emptyset, \{I\}, \{m\}, \{S\}, \{i\}, \{s\}, \{I,m\}, \{I,S\}, \{I,i\}, \{I,s\}, \{m,S\}, \{m,i\}, \{m,s\}, \{S,i\}, \{S,s\}, \{i,s\}, \{I,m,S\}, \{I,m,i\}, \{I,m,s\}, \{I,S,i\}, \{I,S,s\}, \{I,i,s\}, \{m,S,i\}, \{m,S,s\}, \{m,i,s\}, \{S,i,s\}, \{I,m,S,i\}, \{I,m,S,s\}, \{I,m,i,s\}, \{I,S,i,s\}, \{m,S,i,s\}, \{I,m,S,i,s\}\}$

c) $|2^N| = 2^{|N|} = 32$

d) $(2^N)^N = \{\{\emptyset, \{I\}\}, \{\{I\}, \{m\}\}, \ldots\}$

e) $M = \{1, 2, 3\}$

$N \times M = \{(i,j) \mid i \in N, j \in M\}$

1.2) (a) nein, da $(x,x) \in M \notin R$

(b) nein

(c) $R = \{(1,5), (5,4), (2,1), (3,1), (5,3)\}$

$R^2 = \{(1,4), (2,5), (3,5), (1,3), (5,1)\}$

$R^3 = \{(1,1), (2,4), (2,3), (3,3), (3,4), (5,5)\}$

$R^4 = \{(1,5), (5,4), (2,1), (3,1), (5,3)\}$

$\rightarrow$

$$R^+ = \bigcup_{k \geq 1} R^k = R \cup R^2 \cup R^3 \cup \ldots$$
$$= R \cup R^2 \cup R^3$$
$$= \{(1,1), (1,3), (1,4), (1,5), (2,1), (2,3), (2,4), (2,5), (3,1), (3,3), (3,4), (3,5), (5,1), (5,3), (5,4), (5,5)\}$$

(d) $S = \{(2,5), (3,2), (1,3), 4,5)\}$

$S^2 = \{(1,2), (3,5)\}$

$S^3 = \{(1,5)\}$

$$S^* = \bigcup_{k \geq 0} R^k = S^0 \cup S^1 \cup S^2 \cup S^3 \cup \ldots$$
$$= S^0 \cup S^1 \cup S^2 \cup S^3$$
$$= \{(1,1), (1,2), (1,3), (1,5), (2,2), (2,5), (3,2), (3,3), (3,5), (4,4), (4,5), (5,5)\}$$

(e) $SR = \{(1,1), (2,3), (2,4), (3,1), (4,3), (4,4)\}$