$$\rho(i) = \begin{cases} 1, & \text{if request No. } i \text{ is accepted.} \\ 0, & \text{if request No. } i \text{ is denied.} \end{cases}, \forall i \in \{1, 2, \ldots, |M|\}. \qquad (1)$$

$$Rev(M_i) = \rho(i) \times Dur_i^V \times \left[\sum_{n_i^V \in N_i^V} dem^V(n_i^V) \times cpu^V(n_i^V) \right.$$
$$\left. + \sum_{l_i^V \in L_i^V} dem^V(l_i^V) \times bw^V(l_i^V) \right]. \qquad (2)$$

$$Cost(M_i) = \rho(i) \times Dur_i^V \times \left[\sum_{n_i^V \in N_i^V} lev^S(M_{i,N}(n_i^V)) \times cpu^V(n_i^V) \right.$$
$$\left. + \sum_{l_i^V \in L_i^V} lev^S(M_{i,L}(l_i^V)) \times len(M_{i,L}(l_i^V)) \times bw^V(l_i^V) \right]. \qquad (3)$$

$$\max \quad \lim_{n \to \infty} \frac{\sum_{i=1}^{n} \rho(i)}{n}, where \rho(i) = \begin{cases} 1, & \text{if } VNR_i \text{ accepted.} \\ 0, & \text{if } VNR_i \text{ denied.} \end{cases}, \qquad (4)$$

$$\max \quad \lim_{T \to \infty} \frac{\sum_{i=1}^{|\mathbf{M}|} Rev(M_i)}{T}, \qquad (5)$$

$$\max \quad \lim_{T \to \infty} \frac{Rev(\mathbf{M})}{T} / \lim_{T \to \infty} \frac{Cost(\mathbf{M})}{T}. \qquad (6)$$

$$\sum_{r=1}^{|N^S|} x_{i,qr} = 1, \qquad \forall n_{i,q} \in N_i^V, \qquad (7)$$

$$\sum_{r=1}^{|P^S|} y_{i,qr} = 1, \qquad \forall l_{i,q} \in L_i^V, \qquad (8)$$

$$\sum_{i=1}^{|N|} x_{i,qr} cpu_i^V(n_{i,q}) \leq cpu^S(n_r), \quad \forall n_{i,q} \in N_i^V, n_r \in N^S, \qquad (9)$$

$$\sum_{i=1}^{|N|} y_{i,qr} bw_i^V(l_{i,q}) \leq \min_{l_j \in p_r} bw^S(l_j), \quad \forall l_{i,q} \in L_i^V, p_r \in P^S, \qquad (10)$$

$$x_{qr} dem^S(n_r) \leq lev^V(n_q), \quad \forall n_q \in N_i^V, n_r \in N^S, \qquad (11)$$

$$x_{qr} dem^V(n_q) \leq lev^S(n_r), \quad \forall n_q \in N_i^V, n_r \in N^S, \qquad (12)$$

$$\begin{aligned} \max\{dem^S(n_r), \max_{x_{qr}=1} dem^V(n_q)\} & \\ \leq \min\{lev^S(n_r), \min_{x_{qr}=1} lev^V(n_q)\} & \end{aligned}, \quad \forall n_q \in N_i^V, n_r \in N^S, \qquad (13)$$

$$dem^V(l_q) \leq \min_{l_i \in p_r, y_{qr}>0} lev^S(l_i), \quad \forall l_q \in L_i^V, p_r \in P^S. \qquad (14)$$