Let the data of the three users at time $n$, $(1 \le n < \infty)$ be $(X_n, Y_n, Z_n)$, which are statistically independent drawings of the dependent vector $(X, Y, Z)$. Let $R_x$, $R_y$, and $R_z$ be the rates of transmission up to the satellite by the three users, and let $T_0$ be the rate of transmission down from the satellite. We show that for data blocks of size $N$, where $N$ is large, the set of rates $(R_x, R_y, R_z, R_0)$ which satisfy

$$R_x > H(X \mid Y, Z), \quad R_y > H(Y \mid X, Z), \quad R_z > H(Z, X, Y),$$
$$R_x + R_y > H(X, Y \mid Z), \quad R_y + R_z > H(Y, Z \mid X), \quad R_x + R_z > H(X, Z \mid Y),$$
$$R_0 > \max[H(X, Y \mid Z), H(X, Z \mid Y), H(Y, Z \mid X)].$$

is necessary and sufficient for the purpose outlined above.

### Some Matching Results in Multi-User Communication

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We derive necessary and sufficient conditions for the reliable transmission of a two-component correlated source over a multi-user channel in two situations. First, matching conditions are derived for sending an arbitrarily correlated two-component source with arbitrarily small probability of error over a capability-degraded broadcast channel (BC). A discrete memoryless BC $\{\mathsf{X}, P(y,z \mid x), \mathsf{Y} \times \mathsf{X}\}$ is said to be capability-degraded if $I(X;Z) \le I(X;Y)$ for all probability distributions $P(x)$ on $\mathsf{X}$. These matching conditions are stated in a computable form. Secondly, we show that the sufficient conditions, obtained by Cover, El Gamal, and Salehi (1980) for reliable transmission of a two-component correlated source over a discrete memoryless multiple-access channel (MAC), are also necessary, if the source $(S,T)$ satisfies the condition that $S$ and $T$ are conditionally independent given their common part $K$. The matching conditions obtained this way include several previously known cases for which necessary and sufficient conditions were found for sending a correlated source reliably over a MAC.

### Suboptimal Link Scheduling in a Network of Directed Transceivers

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The problem of scheduling data transfers in a network $(V,E)$ of transceivers, where preemption of transfers is allowed and transmissions are directed, has been studied by Choi and Hakimi among others. In the network each node $v$ has $b(v)$ transceivers, each link $e$ can have at most $c(e)$ simultaneously communicating pairs of transceivers, and $L_s$ is the size of the smallest odd cycle of $(V,E)$ (hence, $L_s \ge 3$). Choi and Hakimi provided sub-optimal scheduling algorithms that have time complexity $O(|E|^2 \sum_{v \in V} b(v))$ and produce schedules of length at most $[1 + \frac{1}{L_s - 1}]\tau$ where $\tau$ is the length of the optimal schedule. For the case when $c([u,v]) \in \{0, 1\}$ (resp., $c([u,v]) \in \{0, \min\{b(v), b(v)\}\}$) for all links $[u,v]$, we provide an $O(|E|^2 |V|)$ (resp., $O(|E||V|^3)$) time algorithm that produces a schedule with length at most

$$\{1 + 2[(L_s + 1)\min_{v \in V} b(v) + L_s - 3]^{-1}\}\tau \quad \text{(resp., } \{1 + [L_s \min_{v \in V} b(v) - I[\min_{v \in V} b(v) \text{ is odd}]]^{-1}\}\tau).$$

For the case when $c(e) \in \{0, 1\}$ for all links $e$, the scheduling algorithm can be modified to output the schedule in certain useful representations and have smaller time complexities ($O(|E||V|^2)$ or $O(|E|^2)$ depending on the representation).