

## PhD Doctoral Course – Network Design – 10th November 2009

### 9th Assignment

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1. Show that the following pairs of problems are polynomial time equivalent: (1) maximum matching problem (2) maximum integer multi-commodity flow on trees of height 1 and unit capacity edges.
2. Give a polynomial time algorithm for computing a maximum integer multi-commodity flow on unit capacity trees of arbitrary height (Hint: use dynamic programming and a subroutine for the maximum matching problem).
3. Show that if the pruning step (reverse deletion of edges in  $D$ ) of the primal-dual algorithm is removed, the approximation factor is not constant.
4. Show that if the pruning step (reverse deletion of edges in  $D$ ) of the primal-dual algorithm is changed to a forward delete, the approximation factor is not constant.