Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.

2011 (July) PhD Qualifying Exam. Computer Algorithms

1. [25%] Let *S*1 = “aabcdaef” and *S*2 = “beadf” be two strings. Find a longest common subsequence (LCS) of *S*1 and *S*2 via the dynamic programming approach. Please show how to get the answer in detail or get no credit.
2. [25%] Multiplying two *n*-bit numbers *u* and *v* straightforwardly requires *O*(*n*2) steps. By using the divide-and-conquer approach, we can split the number into two equal parts and compute the product by the following method:

*uv* = (*a ⋅* 2*n*/2 + *b*) *⋅* (*c ⋅* 2*n*/2 + *d*) = *ac ⋅* 2*n* + (*ad* + *bc*) *⋅* 2*n*/2 + *bd*.

If (*ad* + *bc*) is computed as (*a* + *b*) (*c* + *d*) *− ac* *− bd*, what is the computing time? Please show how to get the answer in detail or get no credit.

1. [25%] The selection problem: given a set of *n* elements, find the *k*th smallest element of the set. Please use the prune-and-search concept to solve the selection problem in *O*(*n*) time complexity, and show why your solution is in *O*(*n*) time complexity.
2. [25%] Find a minimum cycle basis of the following weighted graph by using Gaussian elimination and the greedy method. Please show how to get the answer in detail or get no credit.

