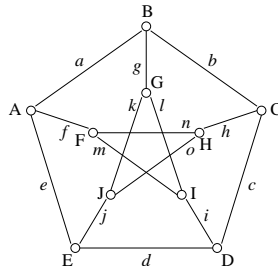
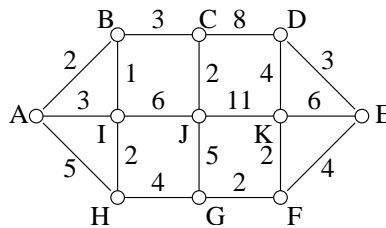


Introduction to Discrete Mathematics Exercise 12

1. Prove: A connected directed multigraph is eulerian if and only if $d^+(v) = d^-(v)$ holds for every vertex v .
2. Give a detailed pseudocode description (with data structures and running time $O(|E|)$) of the algorithm to produce an eulerian trail for undirected eulerian multigraphs $G = (V, E)$!
3. Show that the Petersen Graph is not hamiltonian.



4. Solve the chinese postman problem for the following road map:



5. Let (c_{ij}) be a symmetrical cost matrix for the TSP with only non-negative entries, which satisfies the triangle inequality $c_{ik} \leq c_{ij} + c_{jk}$. Start with an arbitrary vertex v and let $C_1 = \{v\}$. Let $C_k = \{u_1, \dots, u_k\}$ already be constructed. Find $u \notin C_k$ with minimal (cheapest) distance to C_k and introduce u before a vertex with minimum distance. Prove, that a tour constructed this way satisfies $c(T) \leq 2c(T_{opt})$.