1. **(15%)** Explain the following terms:
   (a) Crowdsourcing
   (b) Folksonomies
   (c) Virtualization
   (d) Botnet
   (e) JAD

2. **(10%)** Describe business value of (a) BI (business intelligence) (b) SCM (supply chain management) system.

3. **(9%)** (a) (3%) Explain MapReduce or Hadoop. (b) (3%) Describe their potential applications big data analytics. (c) (3%) Describe the potential difficulties in applying data mining techniques to big data analytics.

4. **(9%)** (a) (4%) Describe the differences between operational CRM and analytical CRM. (b) (5%) Use on-line bookstores as an example, describe functions of operational CRM and analytical CRM.

5. **(7%)** (a) (4%) Describe location-aware on-line advertisements. (b) (3%) Describe approaches that can be deployed to improve the advertisements revenue of portal websites.

6. **(13%)** Below is a subset of relations from **COMPANY** schema. The keys have been underlined.
   EMPLOYEE(EMPNAME, **EmpID**, ADDRESS, SALARY, SupervisorEmpID, DNUMBER)
   DEPARTMENT(DNAME, **DNUMBER**, MANAGERID)
   WORKS_ON(**EmpID, PNUMBER**, HOURS)
   PROJECT(PROJNAME, **PNUMBER**, DNUMBER)
   In a company, each employee works for a department and may work on several projects. The EMPLOYEE table also keeps track of the direct supervisor of each employee. Supervisors are also employees. An employee (supervisor) may be the direct supervisor of several employees.

   Query: For each employee who is a manager and does not work on any project, list the name of the employee and the name of his/her direct supervisor.
   Express the Query in SQL statement by using EXISTS and NOT EXISTS.

7. **(12%)**
   (a) (6%) Explain the embedded SQL approach to database programming. Explain why a precompiler or preprocessor is needed for processing embedded SQL in an application program written by using a general purpose programming language (e.g. C++).
   (b) (6%) Explain the concept of transaction states - partially committed and committed.

8. **(25%)** 國內外許多企業日常的業務及許多管理決策都有賴於資訊系統的正常運作，因此這些企業的資訊單位主管主要的工作責任之一就是督導相關人員維持資訊系統的正常運作。由於各種風險的因素使得資訊系統當機成為資訊單位必須面對的挑戰，如果您是資訊單位的負責人，請問您將如何處理此種挑戰。