1. State Sollin's algorithm to find the minimum cost spanning tree. You should give an example to verify that your stated algorithm is correct. (10%) 

2. Given the postfix representation of an expression: \(ab+c*d+e*f/\), where \(a, b, c, d, e,\) and \(f\) are operands, find the prefix representation of the expression. (10%) 

3. If an array is declared as \(A[a_1,a_2,...,a_n]\) in C language. By row major representation, determine the location of \(A[b_1,b_2,...,b_n]\), where each \(0 \leq b_i < a_i\), within memory. Assume that the starting location of \(A\) within memory is \(X\). (10%) 

4. The ISO Open System Interconnection (OSI) reference model is used as a guideline for communication network development. For each of the functions below, assign the OSI layer at which it is performed. (15%) 
   (a) Packet Routing 
   (b) Encryption/Decryption 
   (c) File Transfer 
   (d) Error Detection 
   (e) Error Recovery 

5. Explain baud rate and bps. (10%) 

6. Manchester and Differential Manchester are commonly used for encoding of digital data. In the Manchester code, there is a transition at the middle of each bit period. The midbit transition serves as a clocking mechanism and also as data: a 0 is represented by a high-to-low transition, and a 1 is represented by a low-to-high transition. In Differential Manchester, the midbit transition is used only to provide clocking. A 0 is represented by the presence of a transition at the beginning of a bit period, and a 1 is represented by the absence of a transition at the beginning of a bit period. Assume the date input sequence is: 001101, draw the output of the two encoding schemes. (10%)
7. (20%)
考慮和公司計畫有關的 database schema 如下:

WORKER (EMPID, EMPNAME, SALARY, EMPDEPT)
PROJECT (PROJNAME, PROJMRG, BUDGET, STARTDATE)
ASSIGN (EMPID, PROJNAME, HOURS, RATING)

其中, PROJMRG 欄位代表 project manager 的名字。ASSIGN relation
記錄員工參加計畫的情形。

回答下列各小題:
a. 寫出一個 SQL 指令去找出 "the names of all workers who have worked
   on any projects managed by Frank Jones" (5%)
b. 寫出一個 SQL 指令去找出 "the names of all workers
   who have been assigned to all the existing projects" (5%)
c. 寫出一個 relational calculus 指令去找出 "the names of all
   workers who have worked on any project with a budget greater
   than $100,000" (5%)
d. 寫出一個 relational algebra 指令去找出 "the names of all
   projects which have been assigned to John Smith" (5%)

8. (15%)
在 Linux 作業系統中, 記憶體的管理使用所謂的 buddy system, 回答下列各小題
a. 以下圖解釋 buddy system 的作法, (5%)
b. 有一個 memory block , 其大小為 4 個 word, 其起始地址為 0110111000, 請問其
   buddy memory block 的起始地址為何? (5%)
c. 有一個 memory block , 其大小為 16 個 word, 其起始地址為 0110111000, 若此 block
   及其 buddy block 均被釋放(free), 則(只)由這兩個 block 所 merge 而成的 32 word 的
   memory block 的起始地址為何? (5%)

```
100k
  |
100k
  |
100k
  | 50k
  |   |
  | a Free
  |   |
  |  |
  | b Allocated
```