每大題十分:

1. Let A = {a, b, 1, 2} and B = {b, d, 1, 3}, what are the answers for the following questions:
   a. $A \cap B$
   b. $|A|$
   c. Is $A \subseteq B$?
   d. $(A - \{1,2\}) \times (B - \{1,3\})$

2. Please write the negation of the statement
   $\forall x \exists y\ T(x)$ and $Q(y)$

3. Please express the complexities of the worst case and best case of the following algorithm in terms of Θ.

```
Integer binary Search (x, {a0, a1, ...an-1})
  low = 0
  high = n – 1
  while low <= high
      mid = |(low + high) / 2|
      If x > amid
        low = mid + 1
      Else if x < amid
        high = mid -1
      Else
        return mid
    return "not found"
End binarySearch
```

4. A kid needs to eat breakfast and lunch, practice piano, read a book and memorize English vocabularies. In how many ways can she/he arrange these activities if breakfast must occur before lunch, and at least one other activity must separate the meals?

5. Determine and explain your decision whether the following event pairs are independent when flipping three fair coins:
   a. (the second is a head and the third is a tail)
   b. (at least one is a head, at least one is a tail)

參考用

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6. Please write a recursive algorithm to compute the summation of 1, 2, .. n with the formula of $\prod^{n}_{k=1} k = n * \prod^{n-1}_{k=1} k$.

7. Determine whether 1011 belongs to each of these regular sets:
   a. $10^*1^*0^*$　　b. $(11 \cup 10)^*$

8. Given a directed graph <V, E>, and a c(i,j), where i,j <=|V|, is the matrix of distance between vertex i and j through no intermediate vertex. Please write an algorithm to compute $C_{|V|}$, the shortest path, between any two vertex through any possible vertex. {hint:

$$C_0(i,j) = \begin{cases} 0 & i = j \\ \infty & \langle i,j\rangle \notin E \text{ and } i \neq j \\ c(i,j) & \langle i,j\rangle \} \in E \end{cases}$$

9. Please build a binary search tree using the following values in a left-to-right order:
   c a e d g f b h.

10. a. Please state the issue of halting problem.
    b. Please argue why halting is not computable.

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