

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (10%) Suppose that each child born is equally likely to be a boy or a girl. Consider a family with exactly three children. Let BBG indicate that the first two children born are boys and the third child is a girl.
 - a. Define a sample space whose outcomes are all possible genders of the three children.
 - b. Write each of the following events as a set and find its probability.
 - i. The event that exactly one child is a girl.
 - ii. The event that at least two children are girls.
2. (10%) A student takes a Truth/False exam with 10 questions. The full marks for the test is 10 points. For a specific question, a student gets one point (+1) when the answer is correct and deducts one point (-1) when the answer is wrong. If the student does not write down the answer, he/she gets zero point (0) for that question. Calculate the expected score for the following two cases.
 - (a) Assume a student does not know the answer. He/she guesses an answer for each problem.
 - (b) Assume a student has 70% confident to the answer of a question. He/she fills an answer for each problem.
3. (10%) If A is late then B is late. If either A or B is late, then the class is boring. Suppose that the class is not boring. What can you conclude about A?
4. (20%) Design a circuit for both four-bit (x,y,z) odd parity generator and five-bit odd parity checker.
5. (15%) Draw the Hasse diagram for $(P(\{1,2,3\}), \subseteq)$, where $P(S)$ denote the power set of S.
6. (15%) Please compute the time complexity of "Bubble Sort". Trace through the bubble sort algorithm for the following data set: $x_1 = 5; x_2 = 4; x_3 = 2; x_4 = 1; x_5 = 3$.
7. (20%) Given a Merge() function (see the following figure). Please write a MergeSort() function. Please compute the complexity of "Merge Sort"

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function Merge( $y_1, y_2, \dots, y_l, z_1, z_2, \dots, z_m \in U$ )
   $i \leftarrow 1, j \leftarrow 1, k \leftarrow 1$ 
  while  $k \leq l+m$  do
    if  $i > l$  then
       $x_k \leftarrow z_j$ 
       $j \leftarrow j+1$ 
    else if  $j > m$  then
       $x_k \leftarrow y_i$ 
       $i \leftarrow i+1$ 
    else if  $y_i \leq z_j$  then
       $x_k \leftarrow y_i$ 
       $i \leftarrow i+1$ 
    else
       $x_k \leftarrow z_j$ 
       $j \leftarrow j+1$ 
     $k \leftarrow k+1$ 
  return  $x_1, x_2, \dots, x_{l+m}$ 

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