Part 1: Introduction of Computer  50%

1. Please fill up the result.
   1) $10010100_2 + 10010000_2 = \underline{\hspace{3cm}}_2 = \underline{\hspace{3cm}}_2$
   2) $BF_{16} + AB_{16} = \underline{\hspace{3cm}}_{16}$
   3) Binary number $01000010_2$, its 2's complement is: $\underline{\hspace{3cm}}_2$
   4) $-6 + 2 = \underline{\hspace{3cm}}$. using 8 bits (including sign bit) to represent result in 2's complement format.

2. Explain the following terms (describing its function or meaning) :  15%
   a) Huffman encoding  b) Algorithm
   c) AND gate  d) Demorgan laws
   e) Cache

3. [von Neumann architecture]:  10%
   a) Please describe the characteristics of von Neumann architecture. Draw the diagram to explain the units in the architecture.
   b) Draw and explain each phase in fetch-execute cycle.

4. [Operating System]  10%
   a) What are the main functions of O.S.
   b) As shown in right figure, two new jobs arrive, requiring 2MB and 5MB respectively, please show memory allocation for the two jobs based on these approaches below:
      allocation approaches: i) best fit  ii) worst fit  iii) first fit.

Free memory:
- 2MB
- 4MB
- 7MB
- 5MB
Part 2: Programming

1. (10%) Answer the following questions for C++.
   (a) What's the difference between 'Q' and 'Q'?
   (b) Declare a variable str with 10-character array, and initialize it at declaration to a string "welcome".

2. (10%) During execution of the following program segment:
   (a) How many times does the first cout execute?
   (b) How many times does the second cout execute?
   ```
   for (int i = 0; i < 7; ++i) {
       for (int j = 0; j < i; ++j)
           cout << i * j << endl;
       cout << endl;
   }
   ```

3. (10%) What are the values of p and q after execution of those statements fragment?
   ```
   j = 5;
   k = 2;
   n = j - +k;
   m = j-- + k--;
   p = k + j;
   q = n + m;
   ```

4. (10%) What are the values of main function variables x and y at the point marked /* values here */ in the following program?
   ```
   void silly(int x);
   int main(void) {
       int x, y;
       x = 3;  y = 8;
       silly(x);
       silly(y); /* values here */
   }
   ```

5. (10%) What are the values of main function variables x and y at the point marked /* values here */ in the following program?
   ```
   void silly(int *x);
   int main(void) {
       int x, y;
       x = 3;  y = 8;
       silly(&x);
       silly(&y); /* values here */
   }
   ```