UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	COMPUTER SYSTEMS ENGINEERING
COURSE CODE	:	BEC 41603
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Identify two (2) facts about ISA.

(2 marks)

(b) Explain three (3) pipeline issues.

(3 marks)

(c) Write a simple coding to make five (5) times addition process using counter.

(5 marks)

(d) (i) Analyze **Figure Q1(d)** based on your knowledge of processor design trend.

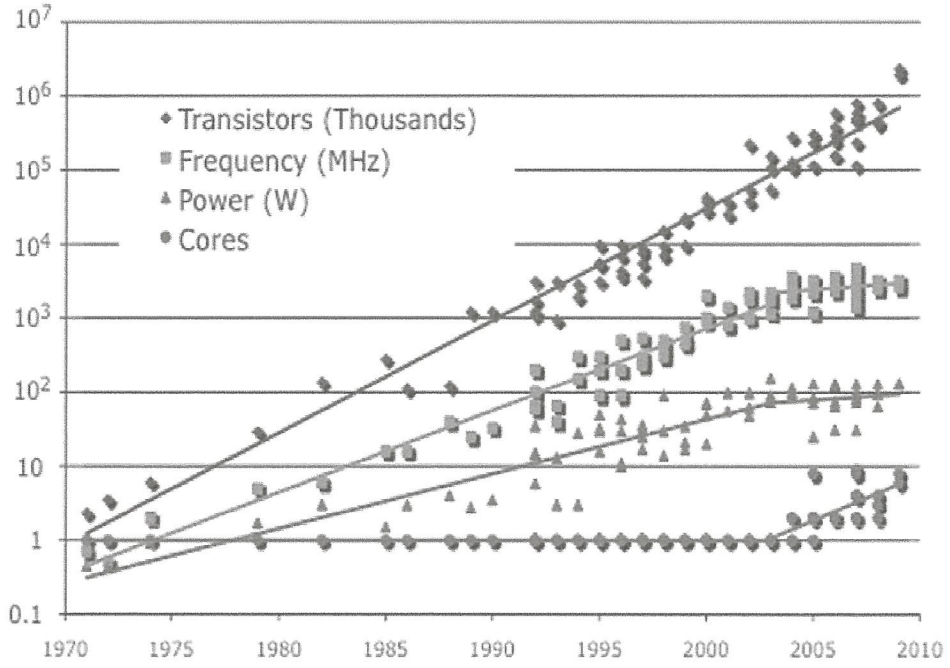

Figure Q1(d)

(5 marks)

(ii) Analyze the suitable application for symmetric and asymmetric multiprocessing.

(5 marks)

(iii) Relate the issues below to the power consumption limitation.
- Long pipeline stages
- Faster clock

(5 marks)

Q2 (a) List the issues in single core processor.

(4 marks)

(b) Explain the gap difference between CPU and memory speed.

(3 marks)

(c) As system engineer, you have been asked to design a multicore processor. Apply the suitable strategy to make your system better than single core processor.

(5 marks)

(d) Perform the execution for the sequential consistency programming at **Figure Q2(d)** if both of processes run concurrently by giving an explanation on each program flow and the last output.

Process 0	Process1
{initially, x=1,y=1}	
x:=2;	y:=2
if (y=1) then x:=3;	if (x=1) then y:=3;
print x;	print y;

Figure Q2(d)

(5 marks)

(e) Analyzes the program at **Figure Q2(e)** by giving a reason why the program produce register 1=1, register 3=2, register2 = register4 = 0.

Initially a= flag1=flag2=0	
Process 1	Process 2
flag1=1	flag2=1
a=1	a=2
register1=a	register3=a
register2=flag2	register4=flag1

Figure Q2(e)

(6 marks)

(f) Develop the timeline to illustrate your analysis.

(2 marks)

Q3 (a) State the advantages of parallelism with example.

(3 marks)

(b) Explain three (3) types of speed up and its formula.

(6 marks)

(c) Assume that a computer has 16 cores that can be used to execute an application in parallel and 88% of application code is parallelizable.

(i) Using Amdahl's Law, calculate the numbers of cores that are needed to achieve a speedup of 8.

(2 marks)

(ii) Determine whether it is possible to achieve a speedup of 6 using the same law as in **Q3(c)(i)** for the application on the given computer.

(3 mark)

(d) Answer the following questions based on the code shown in **Figure Q3(d)**:

```
1  int main ( )
2  {
3      int i, n = 1000;
4      double s = 1.23, x[1000], y[1000];
5      for ( i = 0; i < n; i++ )
6      {
7          x[i] = ( double ) ( ( i + 1 ) % 17 );
8          y[i] = ( double ) ( ( i + 1 ) % 31 );
9      }
10     for ( i = 0; i < n; i++ )
11     {
12     x[i] = x[i] + s * y[i];
13     }
14     return 0;
15 }
```

Figure Q3(d)

Determine the lines of code that can be executed in parallel.

(3 marks)

(e) Based on the C++ code snippet shown in **Figure Q3(e)**, answer the following questions:

```
1  int s = 0, N = 100, A[100];
2  #pragma omp parallel for
3  for (i=0; i<N; i++)
4  {
5      A[i] = i + 1;
6      s+ = A[i];
7  }
```

Figure Q3(e)

(i) Decide whether data race condition happens in the code. If yes, write the specific lines of code and explain.

(3 marks)

(ii) Give a reason whether the answer in **Q3(e)(i)** is considered as the critical section.

(2 marks)

(iii) Write two suitable OpenMP directives to execute the critical section.

(3 marks)

Q4 (a) Describe the race condition situation.

(3 marks)

(b) Explain how to avoid the data races.

(3 marks)

(c) Differentiate between CPU and GPU.

(4 marks)

(d) GPU execution process involves the following steps shown in **Figure Q4(d)**. Rearrange the processes in the correct execution order.

Free device memory
Memory copy from host to device
Memory space allocation for device
Call kernel "multiply" for parallel execution in device
Memory copy from device to host

Figure Q4(d)

(5 marks)

(e) List the GPU functions to be used for each process listed in **Figure Q4(d)** based on the correct execution order.

(5 marks)

(f) GPU is suitable for SIMD type applications. Elaborate the performance effect when GPU is used to execute non-SIMD applications such as SISD and MIMD.

(5 marks)

– END OF QUESTIONS –