Lebanese University INFO324 - E Partial 2016-2017
Faculty of Sciences I Duration 1 hour

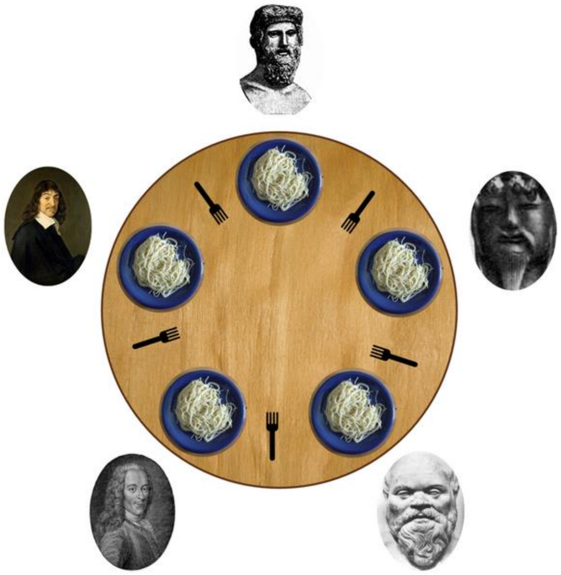
Problem I (7 points):

a) Draw the family tree of the processes generated by this program.

```
#include <unistd.h>
int main(void)
{
    if (!fork())
            fork () && (fork() || (fork() && fork()));
    else
            fork () && fork();
    sleep (2);
    return 0;
}
```

Problem II: Communication and Synchronization (15 points):

Five philosophers spend their lives thinking and eating around a table. To eat, they need two forks, but there are only five forks.



Each philosopher has three states: "I think", "I am hungry", "I eat" by which he always passes in this order. Before beginning to eat, each philosopher must know that both left and right forks are free.

One of the solutions proposed is that each philosopher, when he is hungry, takes the left fork, then the right one eats, then rests them

A) Write a program C that creates 5 processes representing the five philosophers and uses the tools of communication and synchronization already studied in the course to implement this solution.

B) An in-depth study of the previous solution shows that this is a bad solution because it cannot avoid blocking as if each process waits the other and all of them are blocked). Describe in detail the situation that may arise a blocking state and write the solution to avoid this kind of blocking

Problem III (8 points)

Which are the results printed by the two following programs. Justify your answers.

Program 1

```
void main{
      int i;
      for(i=0;i<3;i++){
            fork();
            printf("Good Morning\n");
      }
}
```

Program 2

```
void main{
      int i=2, j=10, p;
      while(i){
            i--; p=fork(); wait(0);
      }
      j += 2;
      if(p==0)    {j += 3; i ++;}
      else        {j *= 2; i *= 2;}
      printf("i=%d, j=%d\n",i,j);
}
```