

MA U11601 Quiz 04 26/11/21, due midnight Monday 29/11/21

Answer any 3 questions. Submit them through Blackboard as pdfs, either handwritten and scanned, or typeset. They should be submitted before midnight on Monday, 29 November. If more than three answers are submitted, only the first three will be marked. All questions carry 20 marks.

Show all work. That is, where an answer requires some calculation, show the calculation.

Plagiarism. If copying is detected, all those involved will lose credit, irrespective of who copied from whom.

Question 1. By analysing the operator precedence, explain

```
% cat xxx.c
#include <stdio.h>
int main()
{ char x[] = "hello.....",
  y[] = "goodbye";
  printf("%s\n", x);
  char *a = x, *b=y; // a++ increments the address in a by 1
  while ( *a++ = *b++ );
  printf("%s\n", x);
}
% gcc xxx.c
% a.out
hello.....
goodbye
%
```

Question 2. Write a *recursive* routine `printx(int n)`, assuming $n > 0$, prints the (face value) hex encoding of n , one hex digit at a time. (Newlines should be *omitted*).

Hint: `char hex[]="0123456789abcdef";`

Question 3. (i) Simulate `xxx(30)`, where `xxx()` is the following non-recursive function. Remember the ‘staggered’ layout to show the order in which variables are changed (Section 12.10). (ii) What does `xxx(n)` return, for general $n \geq 1$? (iii) Give an invariant for the while-loop.

```
int xxx(int n)
{
  int x,y,z,m;
  m = 0; x = 1; y = 2;
  while ( y <= n )
  { z = 5*y-6*x;
    x = y; y = z;
    ++m;
  }
  return m;
}
```

Question 4. Disambiguate the following by fully parenthesising, and evaluate.
For example,

```
1 - 2*(3.0+4/5) - 6 =
(1 - (2*(3.0+(4/5)))) - 6 =
(1 - 2*(3.0+0))-6 = (1-6.0) -6 = -11.0
-----
```

- | | |
|-------------------------|--------------------|
| (i) 1 - 2/3 + 4.0 | (ii) 1 - 2/3.0 + 4 |
| (iii) 3*4/2 | (iv) 3/2*4 |
| (v) 1 - (2 - 3 - 4.0) | |

Question 5. (i) Carefully simulate `xxx(875,2)`, showing the stack frames associated with each call to `xxx()`, and using indentation to identify them clearly (Section 18):

```
int xxx ( int n, int p )
{
    int q;
    if ( n%p == 0 )
        return p;
    else
    { q = xxx (n,p+1);
      return q;
    }
}
```

(ii) What does `xxx(n,2)` return, given general $n \geq 2$?

Question 6. Identify five mistakes in the program below. Some mistakes may be errors which block compilation, others may raise warnings, and others may be compiled but not work properly.

```
#include <stdio.h>
void xx(int m[4])
{
    int s =0;
    for (i=0; i<4; ++i);
    { s+=m[i]};
    return s;
}
main()
{
    char y[16] = "hello";
    for(i=0; i<16; ++i)
        printf(" %d", y[i]);
    printf("%d %d\n",strlen(y), xx(y));
}
```