Final Exam Self-Test for "Introduction to Programming" course

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Total number of pages: 5, total number of points: 102, estimated duration: 60+10 minutes

Question 1

(12 pts, 5 min)

Check out the code below! What do you expect?

(C-code)

```
#define NULL ((void *) 0)
int main()
{  void *p[6];
   void **r=p; p[0]=&p[5]; p[1]=&p[2]; p[2]=NULL; p[3]=&p[1]; p[4]=&p[3]; p[5]=&p[4];
   while (r != NULL)
   {
      printf ("%d\n", r-p);
      r = *r;
   }
}
```

0
5
4
3
1
2

Question 2

(15 pts, 10 min)

Below you can find the code for a sorting algorithm. Write down the otuput of the program

(C-code)

```
void exchange(int *a,int *b) { int c; c=*a; *a=*b; *b=c;};

int main()
{ int a[6]={8,5,6,1,4,2},f,i;
  do
  {
   f=0;
   for (i=0;i<5;i++)
     if (a[i]>a[i+1]){ exchange(a+i,a+i+1);f++;}
   printf ("f=%d, a[0]=%d, a[1]=%d, a[2]=%d, a[3]=%d, a[4]=%d, a[5]=%d\n",
                                  f,a[0],a[1],a[2],a[3],a[4], a[5]);
  } while (f>0);

}
```

f=5, a[0]=5, a[1]=6, a[2]=1, a[3]=4, a[4]=2, a[5]=8
f=3, a[0]=5, a[1]=1, a[2]=4, a[3]=2, a[4]=6, a[5]=8
f=3, a[0]=1, a[1]=4, a[2]=2, a[3]=5, a[4]=6, a[5]=8
f=1, a[0]=1, a[1]=2, a[2]=4, a[3]=5, a[4]=6, a[5]=8
f=0, a[0]=1, a[1]=2, a[2]=4, a[3]=5, a[4]=6, a[5]=8

Question 3

(12 pts, 5 min)

Predict the output resulting from the following snippet!

(C-code)

```
float square( float a){ return a*a;}
float cubic( float a){ return a*a*a;}
float affine (float a){ return a+2.;}

int main()
{
  float (*fp1) ( float); float (*fp2) ( float);

  fp1=square; fp2=affine;
  printf ("1. %f \n", (*fp1)((*fp2)(1.0)));
  fp2=square; fp1=affine;
  printf ("2. %f \n", (*fp1)((*fp2)(1.0)));
  fp1=cubic; fp2=affine;
  printf ("3. %f \n", (*fp1)((*fp2)(1.0)));
  fp2=cubic; fp1=affine;
  printf ("4. %f \n", (*fp1)((*fp2)(1.0)));
}
```

1. 9.000000
2. 3.000000
3. 27.000000
4. 3.000000

Question 4

(14 pts, 5 min)

Predict the output resulting from the following snippet!

(C-code)

```
#include <pthread.h>
#include <stdio.h>

pthread_mutex_t lock;

void *thread(void *argument)
{
      printf("Q\n");
      pthread_mutex_lock(&lock);
      sleep(3);
      printf("Z\n");
      pthread_mutex_unlock(&lock);
      sleep(1); printf("C\n");
}

int main()
{
   pthread_t id;
   pthread_mutex_init(&lock, NULL);
   pthread_create(&id, NULL, thread, NULL);
   sleep(1);
   printf("R\n"); sleep(1);
   pthread_mutex_lock(&lock);
   printf("T\n");
   pthread_mutex_unlock(&lock);
   printf("S\n");
   pthread_join(id, NULL);
   printf("F\n");

}
```

Q
R

Z
T
S
C
F

Question 5 (14 pts, 5 min)

Predict sequence of items in the print out

(C-code)

```
typedef struct {int ID; void *next;} Student;

Student *enter_val(int ID, void *next)
{
  Student *current = malloc(sizeof(Student));
  current->ID=ID; current->next=next;
  return current;
}

void print_list(Student *li)
{ if (li!=NULL) {
     printf ("ID: %d \n", li->ID);
     print_list(li->next);}
}


int main()

{
    Student *li, *a, *b;
    li=enter_val(101, NULL);
    li=enter_val(102, li);
    li=enter_val(103, li);
    li=enter_val(104, li);
    print_list(li);
    a=li->next;
    b=a->next;
    a->next=b->next;
    li->next=b;
    b->next=a;
    print_list(li);
}
```

ID: 104
ID: 103
ID: 102
ID: 101
ID: 104
ID: 102
ID: 103
ID: 101

Question 6 (14 pts, 10 min)

Write down the print out from the following python program!

(Python-code)

```
def h(i):
    if i < 1: return i
    else: return i - h(h(h(i-1)))

for i in range(7):
    print i, h(i)
```

0 0
1 1
2 1
3 2

4 3
5 4
6 4

Question 7 (18 pts, 10 min)

Write down the print out from the following python program!

(Python-code)

```
def gcd(a,b):
    print "a=",a," b=",b
    d = a%b
    if d == 0: return b
    else:
        return gcd(b,d)

print gcd(160,90)
```

a= 160 b= 90
a= 90 b= 70
a= 70 b= 20
a= 20 b= 10
10

Question 8 (3 pts, 10 min)

Postscript: What is the resulting stack that you expect after the following code has been executed?

(Postscript-code)

```
/tt
{
  /c exch def
  c 0 gt
  {
   /a exch def
   /b exch def
   b a a b add
   c 1 sub tt
  } if
} def

1 5 5 tt
```

[1, 5, 6, 11, 17, 28, 45]