University of Arizona, Department of Computer Science

CSc 340 Foundations of Computer Systems — Homework 4

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Due Tuesday, May 1

1. Suppose in a heap organisation the free list has four regions of size $\langle 20, 10, 15, 10 \rangle$. We want to allocate data of the sizes $\langle 12, 8, 5, 2 \rangle$. Give the status of the free list after every malloc operation for the following allocation algorithms:

   (a) Best Fit

   (b) Worst Fit

   (c) First Fit

   (d) Next Fit.

2. What is the output of the following program segment? Also explain what each instruction does.

```
main(){
   int  count = 10, *temp, sum = 0;
   temp = &count;
   *temp = 20;
   temp = &sum;
   *temp = count;
   printf("count = %d, *temp = %d, sum = %d\n", count, *temp, sum);
}
```

3. Explain what happens when the following C codes get executed: (A macro that takes arguments expands into in-line code where each occurrence of a formal parameter is replaced by the corresponding actual argument.)

   (a)
```
#include <stdio.h>
#define max(A,B)  ((A) > (B) ? (A) : (B))
main(){
   int i,j,k;
   i = 5;
   j = 6;
   k = max(i++,j++);
   printf(" i = %d , j = %d , k = %d \n",i,j,k);
}
```

(b)
```
#include <stdio.h>
#define square(x) x * x
main() {
   int a,b;
   a = 5;
   b = square(a+1);
   printf(" a = %d , b = %d \n",a,b);
}
```

4. Write a C function that evaluates the area of a given geometric figure. The data structures are defined as follows:

```
typedef enum {CIRCLE, RECTANGLE} figure;
typedef struct rect{
    int x;
    int y;
}rect;
typedef struct geometry{
    figure type;
    union{
       int radius;
       rect rectangle;
    }parameter;
} geometry;
```

The `type` field of the geometry structure takes the value of `CIRCLE` if it is a circle and a value of `RECTANGLE` if it is a rectangle. The area of a circle with radius r is computed as $3.14 * r^2$. The area of a rectangle is given by the product of its sides.

5. Write a function

```
char* strncpy(s,ct,n)
```

The variables `s` and `ct` are of the type `char*` and `n` is of the type `unsigned int`. This function copies at most `n` characters of string `ct` to `s` and returns `s`. The function also has to pad `s` with `'\0'`s if `ct` has fewer than `n` characters.