ES 112 Second Midterm Examination
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Fall 2003-2004

1 Recursive Function

(30 Points)

The function $f(n)$, where n is a nonnegative integer, is defined to as:

$$\begin{aligned} f(0) &= 2 \\ f(1) &= 5 \\ f(n) &= 2f(n-1) - f(n-2), \quad n \geq 2 \end{aligned}$$

Write a C function that takes the number n as its argument, and calculates and returns $f(n)$ as an integer. If $n < 0$, the function should return -1. The prototype is:

```
int f(int n);
```

2 A String Function

(35 Points)

Implement the following (standard C string library) function:

```
char *strcat(char *dest, const char *src);
```

The `strcat()` function appends the `src` string to the `dest` string overwriting the '\0' character at the end of dest, and then adds a terminating '\0' character. The function returns a pointer to the resulting string `dest`.

3 The Harmonic Mean

(35 Points)

The harmonic mean of n numbers $x_1, x_2, \ldots, x_n$, H, is defined by the following equation:

$$\frac{1}{H} = \frac{1}{n} \cdot \left(\frac{1}{x_1} + \frac{1}{x_2} + \cdots + \frac{1}{x_n} \right)$$

Write a function that takes two arguments: a pointer to the beginning of an array of `doubles`, and the number of elements in the array; and returns the harmonic mean of the numbers in the array. You may assume that all numbers in the array are non-zero. The prototype of the function should be:

```
double harmonicMean (double *numbers, int n);
```