



Texas Instruments Robotics System Learning Kit



TEXAS INSTRUMENTS



# Module 4

Activity: Software Design using MSP432



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## Question 1

Write a C function that returns true if an ASCII character is a letter, and false otherwise. The letters exist from 0x41 to 0x5A and from 0x61 to 0x7A inclusive. The prototype for this function is

```
int bLetter(char data);
```

## Question 2

Write a C function to calculate the average of three numbers. Assume the three numbers are passed by value into your function. The prototype for this function is

```
int32_t Average(int32_t n1, int32_t n2, int32_t n3);
```

## Question 3

Write a C function to find the maximum of three numbers. Assume the three numbers are passed by value into your function. The prototype for this function is

```
int32_t Max(int32_t n1, int32_t n2, int32_t n3);
```

## Question 4

Write a C function to calculate the quadratic equation

$$y = 2x^2 - 3x + 1$$

assuming x and y are 32-bit numbers. Some values of x will cause the calculation of y to extend beyond the values allowed by 32-bit signed numbers. Determine the largest possible value for x, such that  $y < 2^{31}$ . Use this threshold to return  $y = 0x7FFFFFFF$  ( $2^{31}-1$ ) if the input value would create overflow. Determine the smallest possible value for x, such that  $y > -2^{31}$ . Use this threshold to return  $y = 0x80000000$  ( $-2^{31}$ ) if the input value would create underflow. The prototype for this function is

```
int32_t Quadratic(int32_t x);
```

## Question 5

Write a C function that calculates the square distance between two points  $(x_1, y_1)$  and  $(x_2, y_2)$

$$d = (x_1-x_2)^2 + (y_1-y_2)^2$$

assuming  $x_1$ ,  $x_2$ ,  $y_1$ , and  $y_2$  are signed 32-bit numbers. You may assume the numbers are small enough that overflow does not occur. The prototype for this function is

```
int32_t SquareDistance(int32_t x1, int32_t y1,  
                      int32_t x2, int32_t y2);
```

## Question 6

Write a C function that returns true if  $10 \leq x < 99$ , and false otherwise. The prototype for this function is

```
int bTwoDigit(uint32_t x);
```

## Question 7

Unsigned 32-bit numbers range from 0 to  $2^{32}-1$  (4294967295). Write a C function that takes an unsigned 32-bit number and returns a result from 0 to 10 defining the number of decimal digits required to represent the number. For example, the input of 0 returns 0, the input of 1 – 9 returns 1, the input of 10 – 99 returns 2, etc. The prototype for this function is

```
uint32_t NumDigits(uint32_t x);
```

## Question 8

Write a C function that multiplies two unsigned 32-bit numbers. Implement overflow detection such that if the product were to exceed  $2^{32}-1$ , the function returns  $0xFFFFFFFF$  ( $2^{32}-1$ ). The prototype for this function is

```
uint32_t Product(uint32_t n1, uint32_t n2);
```

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