TI-RSLK MAX
Texas Instruments Robotics System Learning Kit
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

```c
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

```c
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

```c
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

```c
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

```c
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

```c
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

```c
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

```c
uint32_t Product(uint32_t n1, uint32_t n2);
```
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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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