**Testing**

When I started the project, I planned to use unit testing, and perform test driven development; due to the project making heavy use of the compiler compilers lex and yacc, however, I could not come up with a good way of performing unit testing on my programs. In light of this, I’ve decided to carry out testing of key functions in isolated source files with tailored test cases. The testing of the lexing and parsing elements of the programs will be done via white box testing.

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| Function prototype | int swapIndexEndianness(int n) |
| Purpose | Swap the endianness of the integer “n” and return it. |
| Testing code | #include <stdio.h>  struct testCase {  int input;  int expectedOutput;  };  int swapIntEndianness(int n) {  int o = 0;    for (int i = 0; i < 4; i++) {  \*((char \*) &o - i + 3) = \*((char \*) &n + i);  }    return o;  }  int main(int argc, char \*argv[]) {  struct testCase tests[] = {{0x00000000, 0x00000000},  {0x000000FF, 0xFF000000},  {0x0000FF00, 0x00FF0000},  {0x00FF0000, 0x0000FF00},  {0xFF000000, 0x000000FF},  {0x12345678, 0x78563412}};    int actualOutput;    printf("Input Expected Actual \n");    for (int i = 0; i < sizeof(tests) / sizeof(struct testCase); i++) {  actualOutput = swapIntEndianness(tests[i].input);    printf("%08X %08X %08X", tests[i].input, tests[i].expectedOutput, actualOutput);    if (actualOutput != tests[i].expectedOutput) {  printf(" FAIL\n");    continue;  }    printf(" PASS\n");  }    return 0;  } |
| Outcome | F:\School work\A Level\Computer Science\MML-To-Midi-Project\Project Documentation\Test images\swapIntEndianness_test.PNG |

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| Function prototype | int writeVariableLengthQuantity(char \*ptr, int n) |
| Purpose | Write the integer “n” as a big endian variable length quantity at the pointer “ptr”.Return the length of the variable length quantity written. |
| Testing code | #include <stdio.h>  struct testCase {  int inputN;  int expectedVLQ;  int expectedReturn;  };  int writeVariableLengthQuantity(char \*ptr, int n) {  if (!n) {  \*ptr = 0;  return 1;  }    int length = 5;    for (int i = 4; i >= 0; i--) {  if (n >> i \* 7) {  break;    } else {  length--;  }  }    for (int i = length - 1; i >= 0; i--) {  if (i) {  \*(ptr + length - i - 1) = ((n >> i \* 7) & 0x7F) + 0x80;    } else {  \*(ptr + length - i - 1) = (n >> i \* 7) & 0x7F;  }  }    return length;  }  int main(int argc, char \*argv[]) {  struct testCase tests[] = {{0x00000000, 0x00000000, 0},  {0x00000040, 0x00000040, 1},  {0x0000007F, 0x0000007F, 1},  {0x00000080, 0x00000081, 2},  {0x00002000, 0x000000C0, 2},  {0x00003FFF, 0x00007FFF, 2},  {0x00004000, 0x00008081, 3},  {0x00100000, 0x000080C0, 3},  {0x001FFFFF, 0x007FFFFF, 3},  {0x00200000, 0x00808081, 4},  {0x08000000, 0x008080C0, 4},  {0x0FFFFFFF, 0x7FFFFFFF, 4}};    int actualVLQ;  int actualReturn;    printf("Input n Expected Expected Actual Actual \n");  printf(" VLQ Return VLQ Return \n");    for (int i = 0; i < sizeof(tests) / sizeof(struct testCase); i++) {  actualVLQ = 0;  actualReturn = writeVariableLengthQuantity((char \*) &actualVLQ, tests[i].inputN);    printf("%08X %08X %08X %08X %08X", tests[i].inputN, tests[i].expectedVLQ, tests[i].expectedReturn, actualVLQ, actualReturn);    if (actualVLQ != tests[i].expectedVLQ) {  printf(" FAIL\n");    continue;  }    printf(" PASS\n");  }    printf("\nNOTE: All VLQ values corrected for endianness\n");    return 0;  } |
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| Function prototype | int readVariableLengthQuantity(char \*ptr) |
| Purpose | Read a big endian variable length quantity from pointer “ptr”, and return it as a little endian integer. |
| Testing code | #include <stdio.h>  struct testCase {  char input[4];  int expectedOutput;  };  int readVariableLengthQuantity(char \*ptr) {  char \*originalPtr = ptr;    while (\*(ptr) & 0x80) {  ptr++;  }    int output = 0;  int outputShift = 0;  do {  output |= (\*ptr & 0x7F) << outputShift;    outputShift += 7;    } while (ptr-- != originalPtr);  return output;  }  int main(int argc, char \*argv[]) {  struct testCase tests[] = {{{0x00, 0x00, 0x00, 0x00}, 0},  {{0x40, 0x00, 0x00, 0x00}, 0x40},  {{0x7F, 0x00, 0x00, 0x00}, 0x7F},  {{0x81, 0x00, 0x00, 0x00}, 0x80},  {{0xC0, 0x00, 0x00, 0x00}, 0x2000},  {{0xFF, 0x7F, 0x00, 0x00}, 0x3FFF},  {{0x81, 0x80, 0x00, 0x00}, 0x4000},  {{0xC0, 0x80, 0x00, 0x00}, 0x100000},  {{0xFF, 0xFF, 0x7F, 0x00}, 0x1FFFFF},  {{0x81, 0x80, 0x80, 0x00}, 0x200000},  {{0xC0, 0x80, 0x80, 0x00}, 0x8000000},  {{0xFF, 0xFF, 0xFF, 0x7F}, 0xFFFFFFF}};    int actualOutput;    printf("Input Expected Actual \n");    for (int i = 0; i < sizeof(tests) / sizeof(struct testCase); i++) {  actualOutput = readVariableLengthQuantity(tests[i].input);    for (char c = 0; c < 4; c++) {  printf("%02X", (unsigned char) tests[i].input[c]);  }    printf(" %08X %08X", tests[i].expectedOutput, actualOutput);    if (actualOutput != tests[i].expectedOutput) {  printf(" FAIL\n");    continue;  }    printf(" PASS\n");  }    return 0;  } |
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White box tests here!