Dalhousie University
Department of Electrical and Computer Engineering

ECED 3403 – Computer Architecture

S-Records: Format

The XM23 assembler produces XM23 executable files from XM23 source files. The executable files consist of two or more S-records. The format of the S-record is:

Type	Count	Address	Data	Checksum

The fields are defined as follows:

Type: The record type consisting of the letter ‘S’ followed by the character ‘0’, ‘1’, or ‘9’:

S0: The name of the source module from which the XME was obtained (typically an ASM file).

S1: A data (instruction) record consisting of one or more bytes to be stored in memory.

S9: The starting address of the executable.

Count: The length of the record (the number of Address bytes, Data bytes, and Checksum byte). An 8-bit (char) value. Read the Count as %2x.

Address: The starting address field:

0x0000 in S0 records.

0xnnnn in S1 records.

0xnnnn in S9 records. Default is 0000. If the END directive has a label operand, the address of the label is stored in the Address field.

The address is stored as four characters. The characters should be read in pairs using two %2x (high then low). The bytes can then be shifted into their correct positions:

```
address = ah << 8 | al;
```

Data: The payload, one of:

S0: The name of the source module, stored as ASCII bytes. They can be read as %2x and displayed as a single character (%c).

S1: Data (instruction) bytes. The first byte is stored in the memory location specified in the address field, the second byte is in the address field + 1, and so on.

S9: The field is empty.

Checksum: The one’s complement of the sum of the bytes in the Count, Address, and Data fields, produced by the assembler. When the Checksum field is added to the record’s sum produced by the loader, the result should be -1 (why?). The Checksum should be an unsigned char. The checksum indicates that an error has been found, it does not indicate which byte is the cause of the error. The checksum can be considered a large parity bit, applied to a stream of bytes rather than a single byte.