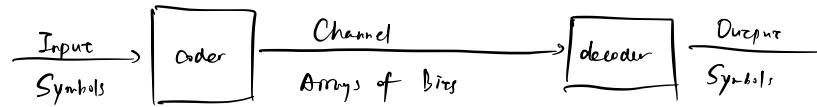# Chapter 2 Codes

Complex objects represented by arrays of bits

Letters : ASCII, Unicodes, Morse Code

Integers: Binary, Gray, 2's complement

Images: GIF, JPEG

Audio: MP3

Video: MPEG

Symbol Space Size

— the number of symbols that need to be encoded.

if size is finite : may be coded in $\lceil \log_2 size \rceil$ number of bits

elif ... infinite but countable: Overflow

..... uncountable: discretisation , approximation irreversible.

Use of Spare Capacity

unused code patterns (size is not 2^k)

strategies:
- Ignore
- map to other values
- reserve for future extensions
- control codes
- Common abbreviations

Fixed / Variable — length Codes

fixed: ~~the~~ same number of bits, easier to deal, parallel transmission

variable: some shorter / longer. determine when one symbol ends / begins

Detail: Integer Codes

binary code for unsigned integers   e.g. memory address

2's complement for signed integers   e.g. ordinary arithmetic

$\left(\begin{array}{l} \text{binary gray code for instruments measuring changing quantities} \\ \qquad\qquad \text{very rarely used} \end{array}\right)$

binary codes: for code of length n, the 2^n patterns represent
integers $0 \sim 2^n - 1$

2's complement: for code of length n, the 2^n patterns represent
integers $-2^{n-1} \sim 2^{n-1} - 1$

represent rule: none—negative (X): same

negative (X): same as $2^n + X$