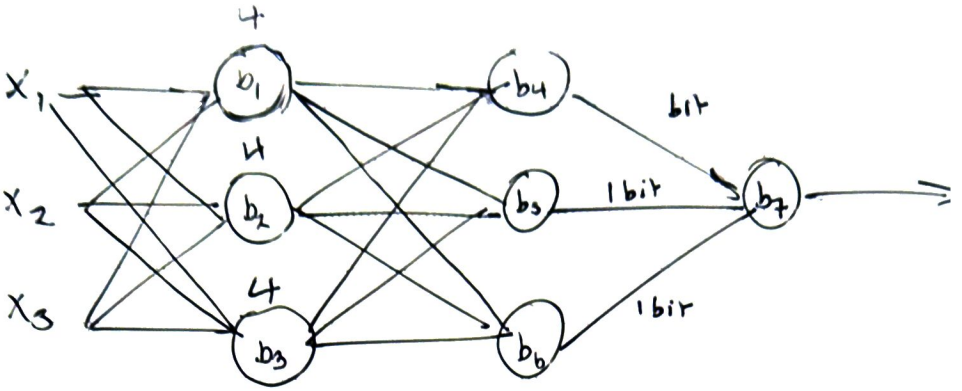
Midterm

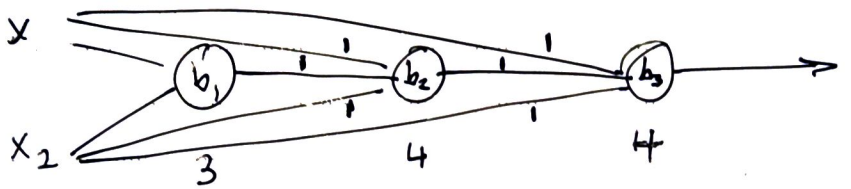
8.1.a.



$3 \times 4 + \min(3 \times 4, 3) + \min(3, 4)$

$= 12 + 3 + 3 = \boxed{18 \text{ bits}}$

8.1 b.



$3 + 4 + 4 = \boxed{11 \text{ bits}}$

Midterm

8.1.c.

a. Binary classification → 1 bit output per row
= 18 rows

b. By same logic: 11 rows

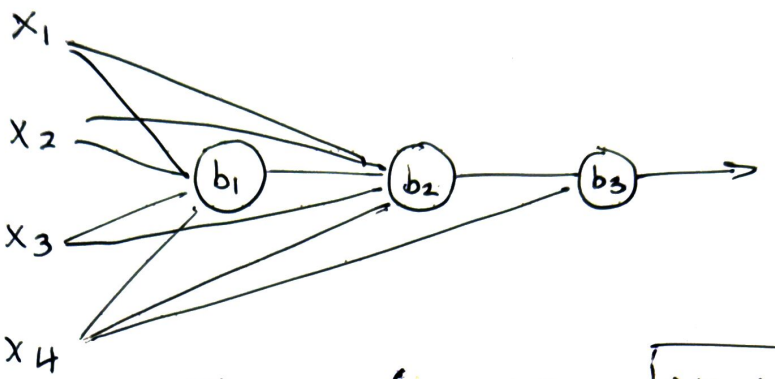
8.1.d. 4-class classification → 2 bits of output per row

a. $\lfloor 18/2 \rfloor$ = 9 rows

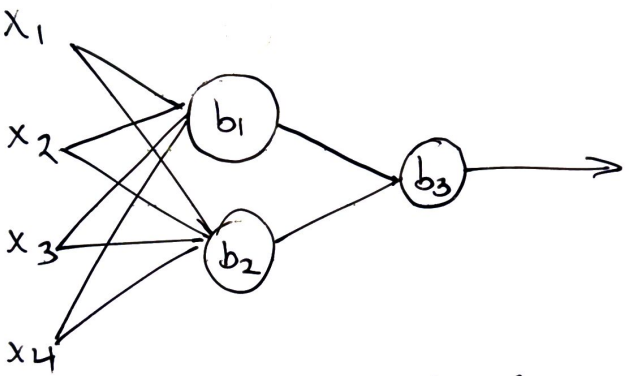
b $\lfloor 11/2 \rfloor$ = 5 rows

Midterm

8.2 12 rows, binary classification
= 12 bit MEC required



$5 + 6 + 3 =$ **14 bits**



$5 \times 2 + \min(2,3) =$ **12 bits**

Midterm

8.4 a.

Total Sensory Exp.

Assumptions:

- Eye "resolution" = 576 MPixels [Clark]
  - ↳ But really 8 MPixels per glance
- Avg 1 glance per second when awake
- Ears intake 100,000 bits/s of info

23 yrs/old · 365 days/yr · 16 (awake) hrs/day · 3600 s/hr

= 483,552,000 seconds awake

= 483,552,000 · 8 MP

= 3,868,416,000 megapixels perceived · 1,000,000 pixels/MP · 24 bits/pixel

= 9.284×10^{16} bits/eye × 2 eyes

+ 483,552,000 s · 100,000 bits/s for auditory

= 1.857×10^{17} bits

Shakespeare

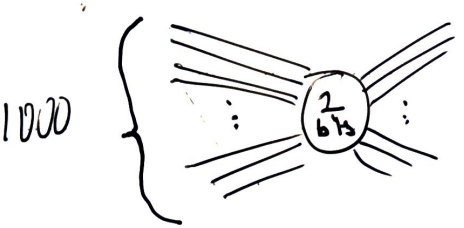
Assumptions:

- 884,647 words in Shakespeare [Spevack]
- 11.82 bits / English word [Shannon]

$= \boxed{10456 \times 10^7 \text{ bits}}$

The Brain

- 10^{11} neurons
- 1000 synaptic connections / neuron
- 2 bits per neuron in capacity



MEC per neuron is 2×1000 bits

Whole brain $= 2 \times 10^3 \times 10^{11}$ neurons $\rightarrow \boxed{2 \times 10^{14} \text{ bit capacity}}$

Memorized

Assume we memorize 0.0001 % of all perceived info:

$= 1.857 \times 10^{11}$ bits memorized $\rightarrow$ not full!