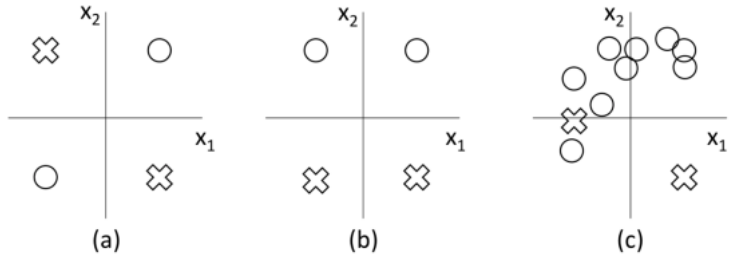
AU332 Quiz8

* 基本信息：

姓名：

学号：

Data Separability



The plots above show points in feature space (x_1, x_2), also referred to as feature vectors $\mathbf{x} = [x_1 \;\; x_2]^T$.

For each of the following, we will define a function $h(\mathbf{x})$ as a composition of some functions f_i and g_i. For each one, consider the decision rule

$$y(\mathbf{x}) = \begin{cases} \times & h(\mathbf{x}) \geqslant 0 \\ \bigcirc & h(\mathbf{x}) < 0. \end{cases}$$

Under each composition of functions h, select the datasets for which there exist some **linear** functions f_i and some **nonlinear** functions g_i such that the corresponding decision rule perfectly classifies the data. (Select all that apply)

*1. h(x) = $f_1(x)$ 【多选题】

- [ ] (a)
- [x] (b)
- [ ] (c)

*2. h(x) = $f_2(g_1(f_1(x)))$ 【多选题】

- [x] (a)
- [x] (b)
- [x] (c)

*3. h(x) = $f_4(f_3(f_2(f_1(x))))$ 【多选题】

- [ ] (a)
- [x] (b)
- [ ] (c)

*4. h(x) = $g_2(g_1(x))$ 【多选题】

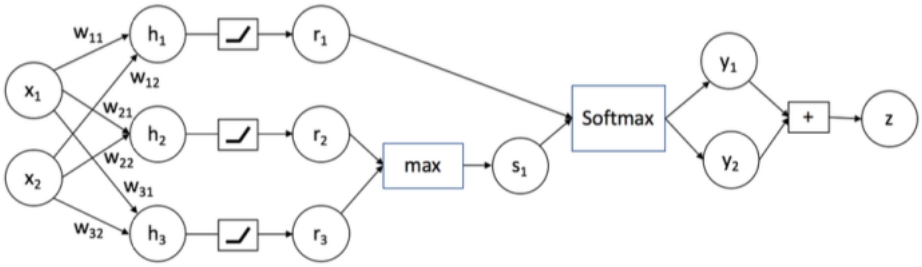
☑ (a)

☑ (b)

☑ (c)

Deep Network

Below is a deep network with inputs x_1, x_2. The internal nodes are computed below. All variables are scalar values.



$$h_1 = w_{11}x_1 + w_{12}x_2 \qquad h_2 = w_{21}x_1 + w_{22}x_2 \qquad h_3 = w_{31}x_1 + w_{32}x_2$$
$$r_1 = \max(h_1, 0) \qquad r_2 = \max(h_2, 0) \qquad r_3 = \max(h_3, 0)$$
$$s_1 = \max(r_2, r_3)$$
$$y_1 = \frac{\exp(r_1)}{\exp(r_1) + \exp(s_1)} \qquad y_2 = \frac{\exp(s_1)}{\exp(r_1) + \exp(s_1)} \qquad (2)$$
$$z = y_1 + y_2$$

Forward propagation: Now, given $x_1 = 1$, $x_2 = -2$, $w_{11} = 6$, $w_{12} = 2$, $w_{21} = 4$, $w_{22} = 7$, $w_{31} = 5$, $w_{32} = 1$, and the same values for x_1, x_2 above, compute the values of the internal nodes. Please simplify any fractions.

*5. h_2: -10

r_3: 3

s_1: 3

z: 1

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