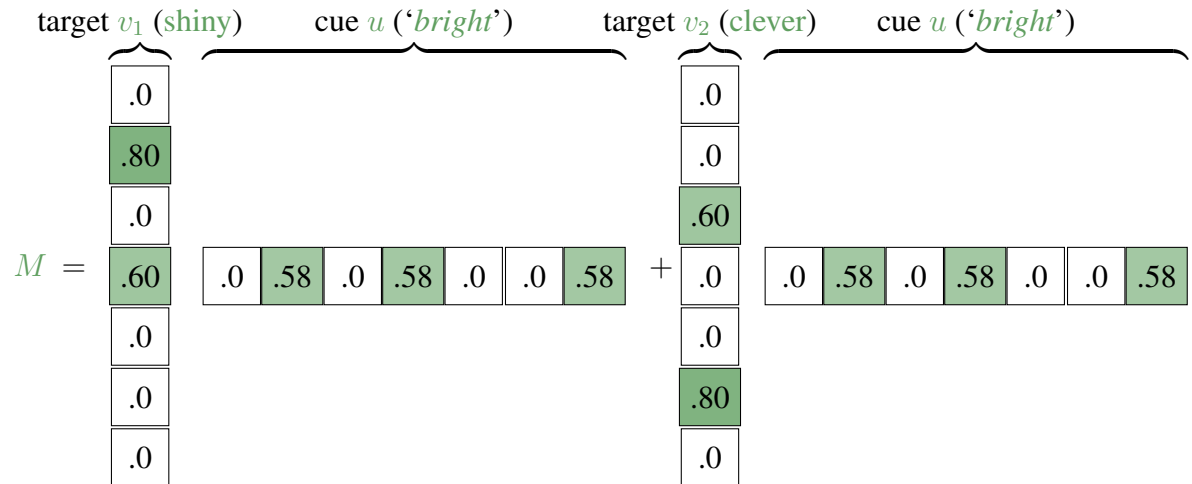


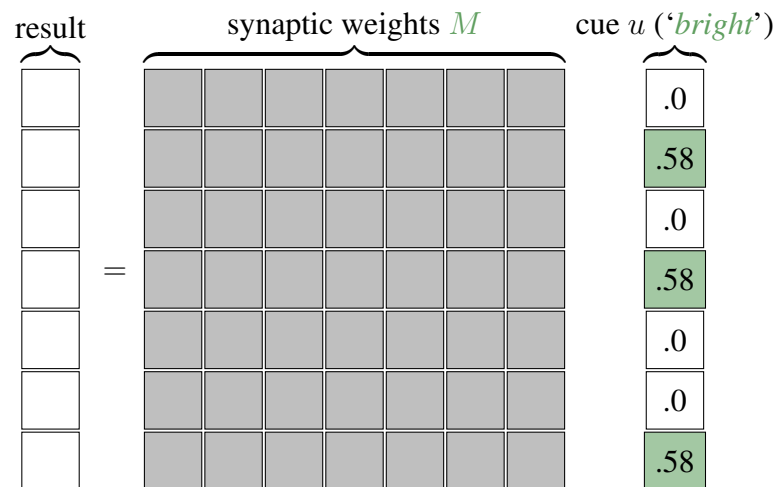
LING3701/PSYCH3371: Problem Set 3

Due via Carmen dropbox at 11:59 PM 6/23.

1. (a) [7 pts.] If associative memory M is made from one cue u and two targets v_1 and v_2 :



what is the result of cueing M with u ? (HINT: You don't need to calculate the matrix!)



- (b) [3 pts.] Describe the result in terms of v_1 and v_2 .

2. (a) [7 pts.] If associative memory M is made from cues u_1 and u_2 and targets v_1 and v_2 :

$$M = \begin{array}{c} \text{target } v_1 \text{ (light)} \\ \begin{array}{|c|} \hline .0 \\ \hline .80 \\ \hline .60 \\ \hline .0 \\ \hline .0 \\ \hline .0 \\ \hline .0 \\ \hline \end{array} \end{array} + \begin{array}{c} \text{cue } u_1 \text{ (shiny)} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline .0 & .80 & .0 & .60 & .0 & .0 & .0 & .0 \\ \hline \end{array} \end{array} + \begin{array}{c} \text{target } v_2 \text{ (student)} \\ \begin{array}{|c|} \hline .0 \\ \hline .0 \\ \hline .0 \\ \hline .60 \\ \hline .0 \\ \hline .80 \\ \hline .0 \\ \hline \end{array} \end{array} + \begin{array}{c} \text{cue } u_2 \text{ (clever)} \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline .0 & .0 & .60 & .0 & .0 & .80 & .0 & .0 \\ \hline \end{array} \end{array}$$

what results from cueing M with a mixture of $.3u_1 + .7u_2$? (You needn't calculate the matrix!)

$$\begin{array}{c} \text{result} \\ \begin{array}{|c|} \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \end{array} \end{array} = \begin{array}{c} \text{synaptic weights } M \\ \begin{array}{|c|c|c|c|c|c|c|c|} \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \square & \square & \square & \square & \square & \square & \square & \square \\ \hline \end{array} \end{array} \begin{array}{c} .3u_1 + .7u_2 \text{ combined cue} \\ \begin{array}{|c|} \hline .0 \\ \hline .24 \\ \hline .42 \\ \hline .18 \\ \hline .0 \\ \hline .56 \\ \hline .0 \\ \hline \end{array} \end{array}$$

- (b) [3 pts.] Describe the result in terms of v_1 and v_2 .

3. (a) [7 pts.] If a filter F is made from auto-associated vectors v_1 and v_3 (NOTE variable names!):

$$F = \begin{matrix} v_1 \text{ (light)} \\ \begin{matrix} .0 \\ .80 \\ .60 \\ .0 \\ .0 \\ .0 \\ .0 \end{matrix} \end{matrix} + \begin{matrix} v_3 \text{ (flight)} \\ \begin{matrix} .58 \\ .0 \\ .0 \\ .0 \\ .58 \\ .58 \\ .0 \end{matrix} \end{matrix}$$

The diagram shows the construction of filter F as the sum of two auto-associated vectors. The first vector, v_1 (light), is a 7x1 column vector with values [.0, .80, .60, .0, .0, .0, .0]. The second vector, v_3 (flight), is a 7x1 column vector with values [.58, .0, .0, .0, .58, .58, .0]. The resulting filter F is a 7x7 matrix, which is the outer product of the two vectors. The matrix is shown as a 7x7 grid of cells, with the first column being the v_1 vector and the first row being the v_3 vector. The values in the matrix are: Row 1: [.0, .80, .60, .0, .0, .0, .0]; Row 2: [.58, .464, .348, .0, .0, .0, .0]; Row 3: [.58, .464, .348, .0, .0, .0, .0]; Row 4: [.0, .0, .0, .0, .0, .0, .0]; Row 5: [.58, .464, .348, .0, .0, .0, .0]; Row 6: [.58, .464, .348, .0, .0, .0, .0]; Row 7: [.0, .0, .0, .0, .0, .0, .0].

what is the result of cueing F with a mixture of $.2v_1 + .8v_2$? (You needn't calculate the matrix!)

$$\text{result} = \text{filter } F \cdot (.2v_1 + .8v_2 \text{ combined cue})$$

The diagram shows the calculation of the result of cueing filter F with a mixture of $.2v_1 + .8v_2$. The result is a 7x1 column vector with values [.0, .16, .12, .64, .0, .0, .48]. The filter F is a 7x7 matrix, and the combined cue is a 7x1 column vector with values [.0, .16, .12, .64, .0, .0, .48]. The result is calculated as the product of the filter F and the combined cue vector.

- (b) [3 pts.] Describe the result in terms of v_1 , v_2 and v_3 .