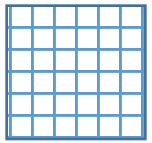
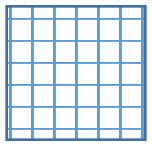
# Data from the content tagging

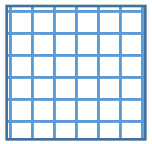
U: # users
Q: # items
K: # knowledge components
M: # adaptive modules

M
Q 

*scope*: boolean, shows items belonging to adaptive modules

K
K 

*m_w*: numeric (0-1), shows pre-requisite relations among knowledge components

K
Q 

*m_tagging*: integer (0 or 1, could be boolean), shows tagging of items with knowledge components

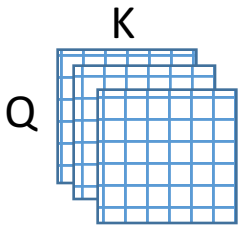
1
Q 

*difficulty*: numeric (0-1), shows tagging of items with difficulty levels

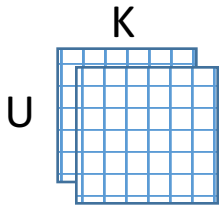
*The ordering of users, items, knowledge components and adaptive modules never changes. Their indices serve as internally used IDs.*

# Data initialized by us

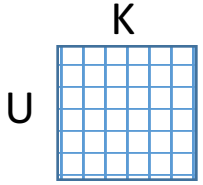
U: # users
Q: # items
K: # knowledge components
M: # adaptive modules



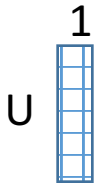

*m_guess, m_slip, m_trans*: numeric (≥0), odds of guessing ,slipping, knowledge transfer



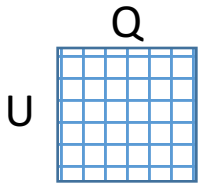

*m_L_i*: numeric (≥0), initial odds of mastery
*m_L*: current odds of mastery, in the beginning of the algorithm initialized equal to *m_L_i*



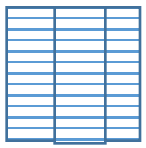

*m_exposure*: integer, # exposures to a KC, initialized with all 0s
*m_confidence*: numeric (≥0), exposure relevance to a KC, initialized with all 0s




*last_seen*: integer, the ID of the item last served to a user.
Initialized with -1s (or any other value not encountered among item IDs)



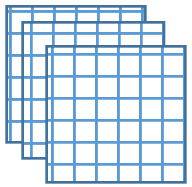

*m_unseen*: boolean, shows which items have been served to a user, initialized with all “True”

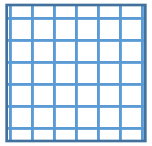


*transactions*: data-frame containing column [user, item, time, score], each row records a transaction.
Initialized with zero rows.

# Data derived for convenience

U: # users
Q: # items
K: # knowledge components
M: # adaptive modules

K
Q  *m_guess_neg_log, m_p_guess, m_slip_neg_log, m_p_slip, m_x0_mult, m_x1_0_mult, m_k*: numeric,

Q
K  *m_difficulty:* numeric, derived from *difficulty*

# Parameters

*epsilon*: numeric (e.g. 1e-10), a convenience cutoff
*eta*: numeric (e.g. 0.0), relevance threshold
*M*: numeric (e.g. 20.0), information threshold

*r_star:* numeric (e.g. 0.0), forgiveness threshold
*L_star*: numeric (e.g. 2.2), mastery certainty threshold (for logarithm of mastery odds)

*W_r, W_c, W_d, W_p*: numeric, importance weights of recommendation sub-strategies.

*stopOnMastery*: boolean, a recommendation strategy parameter