

```

;;
;; K5_no_monochrome_triangle.aem
;;
;; Author: Michael Stephen Fiske

;; T = { {1,2,3}, {1,2,4}, {1,2,5}, {1,3,4}, {1,3,5},
;;       {1,4,5}, {2,3,4}, {2,3,5}, {2,4,5}, {3,4,5}
;;       }.

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;
;; These meta commands repeatedly fire "red" elements: R_12 R_15 R_23 R_34 R_45
;; That is, the meta commands help store the red states of a computation.

(meta (name R_12) (window 0 1)
      (connection (time 0) (from R_12) (to R_12) (amp 2) (width 1-dT) (delay 1)))

(meta (name R_15) (window 0 1)
      (connection (time 0) (from R_15) (to R_15) (amp 2) (width 1-dT) (delay 1)))

(meta (name R_23) (window 0 1)
      (connection (time 0) (from R_23) (to R_23) (amp 2) (width 1-dT) (delay 1)))

(meta (name R_34) (window 0 1)
      (connection (time 0) (from R_34) (to R_34) (amp 2) (width 1-dT) (delay 1)))

(meta (name R_45) (window 0 1)
      (connection (time 0) (from R_45) (to R_45) (amp 2) (width 1-dT) (delay 1)))

;; These meta commands repeatedly fire "blue" elements: B_13 B_14 B_24 B_25 B_35
;; That is, the meta commands help store the blue states of a computation.

(meta (name B_13) (window 0 1)
      (connection (time 0) (from B_13) (to B_13) (amp 2) (width 1-dT) (delay 1)))

(meta (name B_14) (window 0 1)
      (connection (time 0) (from B_14) (to B_14) (amp 2) (width 1-dT) (delay 1)))

(meta (name B_24) (window 0 1)
      (connection (time 0) (from B_24) (to B_24) (amp 2) (width 1-dT) (delay 1)))

(meta (name B_25) (window 0 1)
      (connection (time 0) (from B_25) (to B_25) (amp 2) (width 1-dT) (delay 1)))

(meta (name B_35) (window 0 1)
      (connection (time 0) (from B_35) (to B_35) (amp 2) (width 1-dT) (delay 1)))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;; FIRING RED edges are named R_ij {12, 15, 23, 34, 45}

(element (time -dT) (name R_12) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_15) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_23) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_34) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_45) (threshold 1) (refractory 1) (last -1))

;; Fire element R_ij if edge {j, k} is red where j < k
(fire (time 0) (name R_12))
(fire (time 0) (name R_15))
(fire (time 0) (name R_23))
(fire (time 0) (name R_34))
(fire (time 0) (name R_45))

```

```

;; NON-FIRING RED edges are named R_ij {13, 14, 24, 25, 35}
(element (time -dT) (name R_13) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_14) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_24) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_25) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name R_35) (threshold 1) (refractory 1) (last -1))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;; FIRING BLUE edges are named B_ij
;;
(element (time -dT) (name B_13) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_14) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_24) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_25) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_35) (threshold 1) (refractory 1) (last -1))

;; fire element B_jk if edge {j, k} is blue where j < k.
(fire (time 0) (name B_13))
(fire (time 0) (name B_14))
(fire (time 0) (name B_24))
(fire (time 0) (name B_25))
(fire (time 0) (name B_35))

;; NON-FIRING BLUE edges are named B_ij {12, 15, 23, 34, 45}
(element (time -dT) (name B_12) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_15) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_23) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_34) (threshold 1) (refractory 1) (last -1))
(element (time -dT) (name B_45) (threshold 1) (refractory 1) (last -1))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;; Blue Connections
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;
;; T = { {1,2,3}, {1,2,4}, {1,2,5}, {1,3,4}, {1,3,5},
;;       {1,4,5}, {2,3,4}, {2,3,5}, {2,4,5}, {3,4,5}
;;       }.
;;
;; Three connections are created for each potential blue triangle to
;; determine if a blue triangle exists on vertices {i, j, k} where {i, j, k}
;; ranges over T.

;; ijk = 123
(connection (time 0) (from B_12) (to B_123) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_23) (to B_123) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_13) (to B_123) (amp 2) (width 1-dT) (delay 1))

;; ijk = 124
(connection (time 0) (from B_12) (to B_124) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_24) (to B_124) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_14) (to B_124) (amp 2) (width 1-dT) (delay 1))

;; ijk = 125
(connection (time 0) (from B_12) (to B_125) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_25) (to B_125) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_15) (to B_125) (amp 2) (width 1-dT) (delay 1))

;; ijk = 134
(connection (time 0) (from B_13) (to B_134) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_34) (to B_134) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_14) (to B_134) (amp 2) (width 1-dT) (delay 1))

```

```

;; ijk = 135
(connection (time 0) (from B_13) (to B_135) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_35) (to B_135) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_15) (to B_135) (amp 2) (width 1-dT) (delay 1))

;; ijk = 145
(connection (time 0) (from B_14) (to B_145) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_45) (to B_145) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_15) (to B_145) (amp 2) (width 1-dT) (delay 1))

;; ijk = 234
(connection (time 0) (from B_23) (to B_234) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_34) (to B_234) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_24) (to B_234) (amp 2) (width 1-dT) (delay 1))

;; ijk = 235
(connection (time 0) (from B_23) (to B_235) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_35) (to B_235) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_25) (to B_235) (amp 2) (width 1-dT) (delay 1))

;; ijk = 245
(connection (time 0) (from B_24) (to B_245) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_45) (to B_245) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_25) (to B_245) (amp 2) (width 1-dT) (delay 1))

;; ijk = 345
(connection (time 0) (from B_34) (to B_345) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_45) (to B_345) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from B_35) (to B_345) (amp 2) (width 1-dT) (delay 1))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;; Red Connections
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;
;; TEMPLATE:
;; (connection (time 0) (from R_ij) (to R_ijk) (amp 2) (width 1) (delay 1))
;; (connection (time 0) (from R_jk) (to R_ijk) (amp 2) (width 1) (delay 1))
;; (connection (time 0) (from R_ik) (to R_ijk) (amp 2) (width 1) (delay 1))
;;
;; Three connections are created for each potential red triangle to
;; determine if a red triangle exists on vertices {i, j, k} where
;; {i, j, k} ranges over T.
;;
;; ijk = 123
(connection (time 0) (from R_12) (to R_123) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_23) (to R_123) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_13) (to R_123) (amp 2) (width 1-dT) (delay 1))

;; ijk = 124
(connection (time 0) (from R_12) (to R_124) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_24) (to R_124) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_14) (to R_124) (amp 2) (width 1-dT) (delay 1))

;; ijk = 125
(connection (time 0) (from R_12) (to R_125) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_25) (to R_125) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_15) (to R_125) (amp 2) (width 1-dT) (delay 1))

;; ijk = 134
(connection (time 0) (from R_13) (to R_134) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_34) (to R_134) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_14) (to R_134) (amp 2) (width 1-dT) (delay 1))

```

```

;; ijk = 135
(connection (time 0) (from R_13) (to R_135) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_35) (to R_135) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_15) (to R_135) (amp 2) (width 1-dT) (delay 1))

;; ijk = 145
(connection (time 0) (from R_14) (to R_145) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_45) (to R_145) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_15) (to R_145) (amp 2) (width 1-dT) (delay 1))

;; ijk = 234
(connection (time 0) (from R_23) (to R_234) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_34) (to R_234) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_24) (to R_234) (amp 2) (width 1-dT) (delay 1))

;; ijk = 235
(connection (time 0) (from R_23) (to R_235) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_35) (to R_235) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_25) (to R_235) (amp 2) (width 1-dT) (delay 1))

;; ijk = 245
(connection (time 0) (from R_24) (to R_245) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_45) (to R_245) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_25) (to R_245) (amp 2) (width 1-dT) (delay 1))

;; ijk = 345
(connection (time 0) (from R_34) (to R_345) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_45) (to R_345) (amp 2) (width 1-dT) (delay 1))
(connection (time 0) (from R_35) (to R_345) (amp 2) (width 1-dT) (delay 1))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
Elements that represent each 3-clique
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;; For each vertex set {i, j, k} (triangle) in T, the following elements are created.
;; The triangles are 123, 124, 125, 134, 135, 145, 234, 235, 245, 345

;; Element R_ijk fires when all 3 elements R_ij, R_jk, R_ik fired 1 unit of time ago.
;; Element B_ijk fires when all 3 elements B_ij, B_jk, B_ik fired 1 unit of time ago.

;; 123
(element (time 0) (name R_123) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_123) (threshold 5) (refractory 1) (last -1))

;; 124
(element (time 0) (name R_124) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_124) (threshold 5) (refractory 1) (last -1))

;; 125
(element (time 0) (name R_125) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_125) (threshold 5) (refractory 1) (last -1))

;; 134
(element (time 0) (name R_134) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_134) (threshold 5) (refractory 1) (last -1))

;; 135
(element (time 0) (name R_135) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_135) (threshold 5) (refractory 1) (last -1))

;; 145
(element (time 0) (name R_145) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_145) (threshold 5) (refractory 1) (last -1))

```

```
;; 234
(element (time 0) (name R_234) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_234) (threshold 5) (refractory 1) (last -1))

;; 235
(element (time 0) (name R_235) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_235) (threshold 5) (refractory 1) (last -1))

;; 245
(element (time 0) (name R_245) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_245) (threshold 5) (refractory 1) (last -1))

;; 345
(element (time 0) (name R_345) (threshold 5) (refractory 1) (last -1))
(element (time 0) (name B_345) (threshold 5) (refractory 1) (last -1))
```