GEOGRAPHY Start P١ PZ Doh Washington Islamabad Damascus Nairdoi Nur-Sultan Djibouti Dake Nassau GEOGRAPHY: given a directed graph G with starting vertex, does player I have a winning strategy?

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GEOGRAPHY in PSPACE

GEOGRAPHY & PSPACE <u>GEOGRAPHY (G,s)</u> EVAL (G,v, p, uisited) $copy \leftarrow copy$ of visited with copy [v] = Trueif p = 1 then Visited[v] = False for all V return EVAL(G, s, 1, visited) for all u adjacent to v if visited (u] = False if EVAL(6, u, Z, copy)= Tive return Tive one all per branch of game tree (expunential) return True else for all u adjacent to v recorsion depth < n if visited (u] = False if EVAL(G, u, I, copy)= False return False 1 avray of size n per recursive call Uni) space return Tive QSAT is PSPACE-complete QSATSP GEOGRAPHY So GEOGRAPHY is PSPACE-complete

$(X, \vee X_2 \vee X_3) \wedge (\neg X, \vee X_2 \vee X_3) \wedge (\neg X, \vee \neg X_2 \vee X_3)$
Start
KI CKI
$X_1 \vee X_2 \vee X_3$
(x_2) $(-x_2)$
nx, v X2 v X3
$(-x_1 \vee -x_2 \vee x_3)$
(K3) (-K3)
de , d

QSAT to GEOGRAPHY	
$(X, VX_2 VX_3) \wedge (-X, VX_2 VX_3) \wedge ($	~ X, V ~ X z V X z)
Start	4n+m+l vertices 5 Sn+4m edges
	so polynomial space to build and polynomial time
$\begin{pmatrix} \kappa_2 \\ \ddots \\ $	
$(\sim X_1 \vee \sim X_2 \vee X_3)$	
K3 C-K3 E	
Q. J.	
	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \\ \\ \\ \\ \end{array} \end{array} \end{array} \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$



