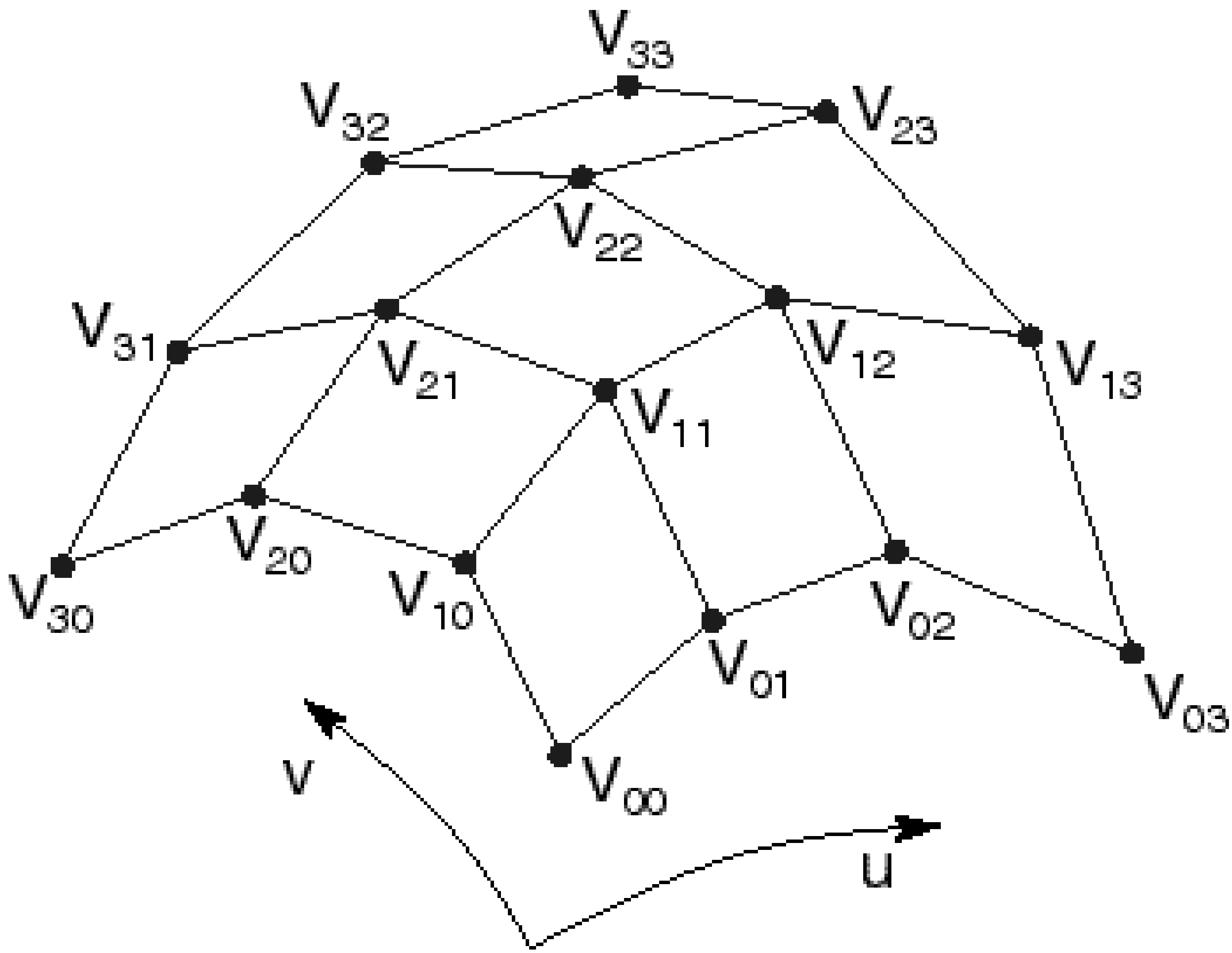
Zoran Popović
Spring 2001

Sample Problems for Final Exam

SURFACES, PARTICLE SYSTEMS

Problem 1.
Draw as best you can the point S(1/3, 2/3) on the Bezier tensor product surface S(u,v) given by the 16 control points below. Make sure you draw all supporting points and curves.



Problem 2

Consider a swept surface defined by a trajectory curve $\mathbf{T}(v) = [x, y, z]^T = [\cos(2\pi v), \sin(2\pi v), 0]^T$ and a profile curve $\mathbf{C}(u) = [x, y]^T = [u, 0]^T$ for $0 \leq u, v \leq 1$.

a) Draw $\mathbf{T}(v)$ and then calculate and draw $\mathbf{T}'(v)$ at some point on the curve.

b) Draw $\mathbf{C}(u)$.

c) (T/F) Consider a Frenet frame positioned on $\mathbf{T}(v)$ as discussed in class. The normal vector n points at the origin.

d) (T/F) Position the profile curve $\mathbf{C}(u)$ in the normal plane of the frame as discussed in class, and vary u and v over their ranges. The surface swept out by C(u) is a sphere.

e) (T/F) There are no inflection points on $\mathbf{T}(v)$ where the curvature $\mathbf{T}''(v)$ goes to 0.

Problem 3

Consider a particle system implemented using only a vector field defined by $\mathbf{v} = \mathbf{h}(x, y, z)$ to control the motion of the particles. Assume that the particles are given a random direction and speed at time 0.

a) (T/F) After one time step, the particles must all be moving in the same direction.

b) (T/F) As time goes on, each particle will reach a maximum speed, depending on its mass.

c) (T/F) A very simple simulation like this can be useful to help visualize the dynamics of a flow field defined by $\mathbf{h}(t)$.