24-681 COMPUTER-AIDED DESIGN Spring 16

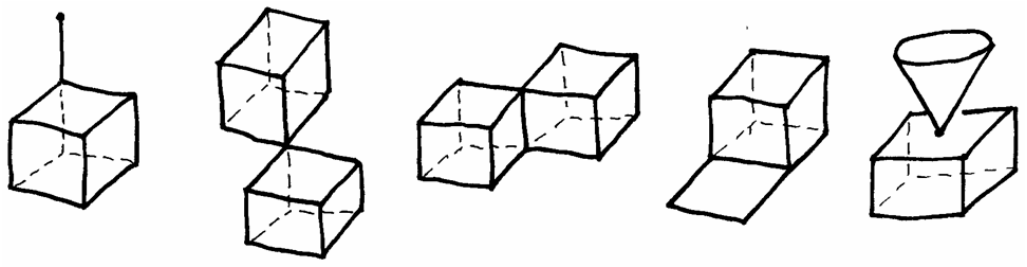
Carnegie Mellon University

PROBLEM SET 10

Due: **4/14/2016 (Thu) 3:00PM @ CERLAB (HH B127)**
Issued: 4/5/2016 (Tue)
Weight: 3% of total grade
Note: * **Attach the last page of the problem set as the cover page of your paper.**

PS10-1 R-Set

Which, if any, of the objects in Figure 1 represent an r-set?



(a) (b) (c) (d) (e)

Figure 1

PS10-2 Plane Model

Figure 2 shows an example of a plane model of a tetrahedron. Write a plane model of the polyhedrons in Figures 3 and 4. (Add special topology if necessary.)

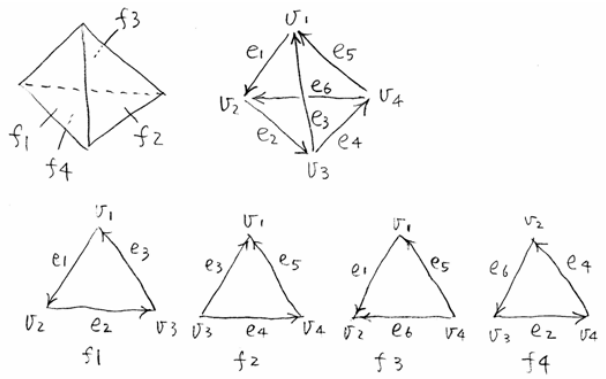


Figure 2

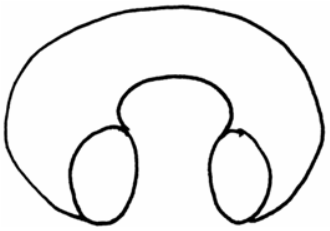


Figure 3

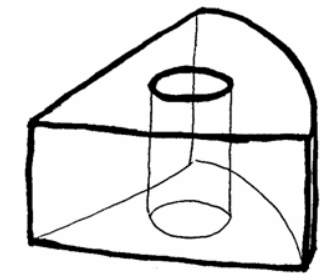


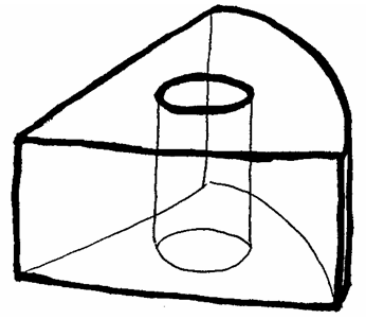
Figure 4

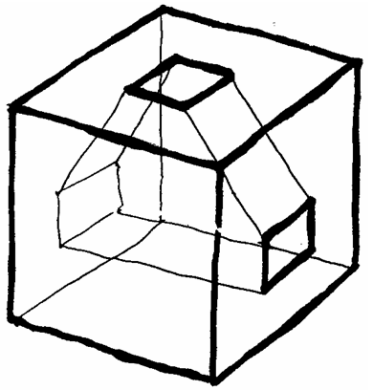
PS10-3 Euler-Poincare Formula

We have learned four types of Euler-Poincare formulas:

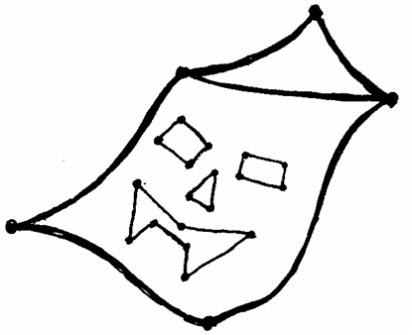
(a) Plane model with no through-holes: v - e + f = 2
(b) Plane model: v - e + f = 2(s-h)
(c) Two-dimensional sheet: v - e + f = 2(s-h) - b
(d) Solid with rings: v - e + f = 2(s-h) + r

(1) Verify the Euler-Poincare formula for plane models for the geometry shown below. Add special topologies if necessary.

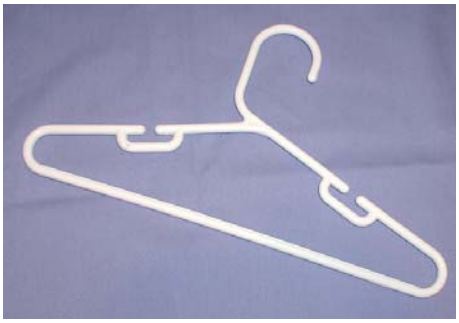




(2) Verify the Euler-Poincare formula for two-dimensional sheets for the geometry shown below. Add special topologies if necessary.



PS10-4 Which of the following objects are homeomorphic, or topologically equivalent? For example, if you think that (a), (b) and (c) are homeomorphic, write "(a), (b) and (c) are homeomorphic" List all the groups of objects that are homeomorphic. Note: there are more pictures on the next page.



(a) hanger

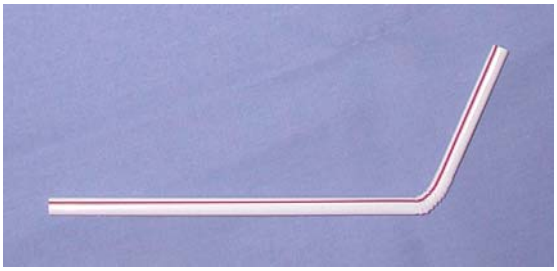
(b) measuring cup

(c) opened soup can

(d) soup can's lid

(e) coffee dripper with three holes on the bottom

(f) scissors

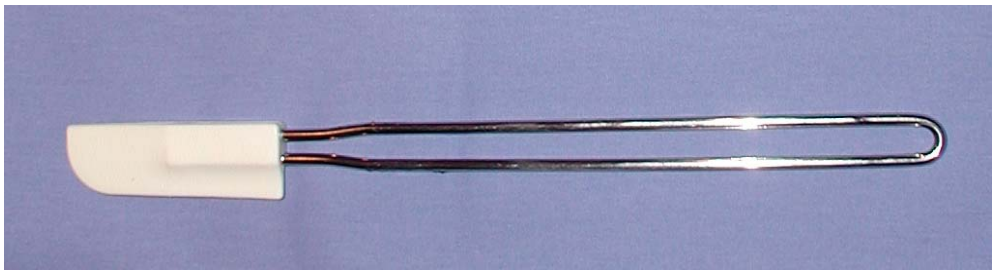


(g) straw

(h) sugar pot

(i) coffee mug

(j) vegetable peeler

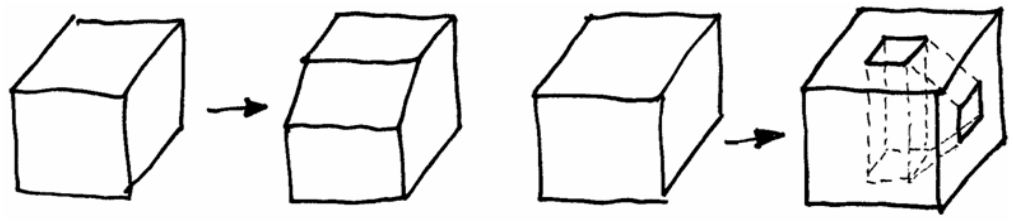


(k) spatula

(l) spaghetti spoon

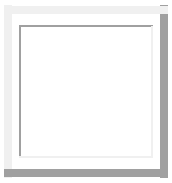
(m) baby toy

PS10 Write sequences of Euler operators that make changes as shown in the figure below. You can use the following Euler operators: mev, mef, mvfs, kemr, kfmrh, kev, kef, kvfs, mekr, and mfkrh. Use some figures to illustrate the process



(a) (b)

PS10



The first letter of your LAST name _____ First Name _____ Last Name

How many hours did you spend to complete this problem set?

_____ Hour(s)

How many no-penalty late days do you want to use for this problem set?

_____ Day(s)

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