C. GAMBIT NEUTRAL FILE FORMAT

GAMBIT neutral files are ASCII files that can be used to import or export mesh data, boundary condition data (points, edges, or surfaces tagged with names) or solution-results data in a node- or cell-based format. The following sections describe the GAMBIT neutral file format. (NOTE: All record data formats are expressed according to Fortran conventions).

C.1 General Format

C.1.1 Format Overview

Header and End-of-Section Records

Each section of a GAMBIT neutral file begins with a header record. The header record consists of a 20-character descriptor followed by a neutral-file version number. (NOTE: The Fortran-style format for the descriptor and version number is (A20,A20).) Each section ends with a record with the string, "ENDOFSECTION". For example, the following lines represent a valid set of data records for the *control information* section (see below) of a GAMBIT neutral file.

```
        CONTROL INFO 1.2.1
** GAMBIT NEUTRAL FILE
Example
PROGRAM:                Gambit     VERSION:  1.2.1
 4 Jan 2000    13:07:49
     NUMNP     NELEM     NGRPS    NBSETS     NDFCD     NDFVL
        60       116         1         2         3         3
ENDOFSECTION
```

The inclusion of header and end-of-section records allows individual sections of a GAMBIT neutral file to be modified while maintaining backward compatibility. It also allows sections to be easily skipped if they are not relevant for a given model.

Blanks and Fixed-Field Format

Each record is formatted using fixed fields with at least one blank character between subsequent fields. The purpose of such formatting is to facilitate reading by programs of any language.

Comment Records

Any record in the neutral file beginning with a "/" character is considered a comment record.

C.1.2 Format Description

The following subsections describe the contents and valid data formats for each section in a GAMBIT neutral file.

Control Information

This section contains summary information for the neutral file.

Header Record Descriptor

```
CONTROL INFO
```

Record 1—Neutral-File Header

Format: `(A)`

Variable	*Description*
`HEDNUT`	String of the form "`** GAMBIT NEUTRAL FILE`"

Record 2—User-Defined Title

Format: `(A80)`

Variable	*Description*
`HED`	80-character title

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Record 3—Data Source and Revision Level

Format: `('PROGRAM: ',A20, 5X,'VERSION: ',F5.2)`

Variable	*Description*
`PROGRAM`	Name of the program that created the neutral file
`REVL`	Revision level

Record 4—Date and Time Record

Format: (*Unformatted—*`DATE` *and* `TIME` *separated by a blank character*)

Variable	*Description*
`DATE`	Date (`DD Mmm YYYY`)—for example, `13 Dec 2001`
`TIME`	Time (`HH:MM:SS`)—for example, `15:03:27`

Record 5—Problem Size-Parameter Headings

Format:
```
(5X,'NUMNP',5X,'NELEM',5X,'NGRPS',4X,
'NBSETS',5X,'NDFCD',5X,'NDFVL')
```

Record 6—Problem Size Parameters

Format: `(/6(1X,I9))`

Variable	*Description*
NUMNP	Total number of nodal points in the mesh
NELEM	Total number of elements in the mesh
NGRPS	Number of element groups
NBSETS	Number of boundary condition sets
NDFCD	Number of coordinate directions (2 or 3)
NDFVL	Number of velocity components (2 or 3)

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Application/Solver Data (*Optional*)

This section contains application and/or solver-dependent data.

Header Record Descriptor

```
APPLICATION DATA
```

Record 1—Application Identification

Format: `(A20, F10.3)`

Variable	*Description*
`APPLIC`	20-character string
`VERSION`	Version number

Record 2—Solver-Dependent Flags Header

Format: `(3I10)`

Variable	*Description*
`NISOLV`	Number of solver-dependent integer values
`NRSOLV`	Number of solver-dependent real values
`NSSOLV`	Number of solver-dependent string values

Records 3 to End of Section—Solver-Dependent Flags

Format: `( (8I10:)/(4E20.12:)/(A/))`

Variable	*Description*
`(ISOLVE(I),I=1,NISOLV)`	Solver-dependent integer values
`(RSOLVE(I),I=1,NRSOLV)`	Solver-dependent real values
`(CSOLVE(I),I=1,NSSOLV)`	Solver-dependent string values

The flags listed above are solver-dependent flags the interpretation of which depends on the program that created the neutral file and the program that is reading the neutral file. Examples of such flags are as follows:

Flag	*Description*
`ITIM`	Steady = 0; Transient = 1
`ITURB`	Laminar = 0; k-ε turbulence =2
`IFREE`	Fixed mesh = 0; Deformable mesh = 1
`ICOMPR`	Incompressible = 0; Compressible = 2
`ITMP(N)`	Transport equation: Solution not present = 0 ; Solution present = 1 N = 1; Energy equation (temperature) N = I+1; Species equation I

Nodal Coordinates

This section contains nodal point coordinate data. Each of the NUMNP nodes requires a separate record, therefore this section includes NUMNP+2 records.

Header Record Descriptor

```
NODAL COORDINATES
```

Records 1 to NUMNP—Node Point Coordinate Data

Format: `(I10,1X,3E20.12)`

Variable	*Description*
`ND`	Global node number (not required to be sequential or continuous.)
`(X(I),I=1,NDFCD)`	Nodal coordinates

Element/Cell Connectivity

This section contains element and cell connectivity data. Each of the NELEM elements requires a separate data record, therefore this section includes NELEM+2 records.

Header Record Descriptor

```
ELEMENTS/CELLS
```

Records 1 to NELEM—Node Point Coordinate Data

Format: `(I8,1X,I2,1X,I2,1X,7I8:/(15X,7I8:))`

Variable	*Description*
`NE`	Global element number (not required to be sequential or continuous)
`NTYPE`	Element geometry type: 1 = Edge 2 = Quadrilateral 3 = Triangle 4 = Brick 5 = Wedge (Prism) 6 = Tetrahedron 7 = Pyramid
`NDP`	Number of nodes that define the element
`NODE`	List of nodes that define the element (see Section C.2 for ordering conventions)

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Element Group Information

This section contains information for NGRPS element groups (entities or zones). Each element group is preceded by a separate header record.

Header Record Descriptor

```
ELEMENT GROUP
```

Record 1—Element Group Control Information Record

Format: `('GROUP: ',I10,' ELEMENTS: ',I10,'MATERIAL: ' I10,' NFLAGS:',I10)`

Variable	*Description*
NGP	Element group number
NELGP	Number of elements in group
MTYP	Material type (NOTE: Interpretation of this flag is solver-dependent.) 0 = Undefined 1 = Conjugate 2 = Fluid 3 = Porous 4 = Solid 5 = Deformable
NFLAGS	Number of solver-dependent flags

Record 2—Entity Type Record

Format: `(A32)`

Variable	*Description*
ELMMAT	Identifying name of element group (or entity or zone)

Record 3—Solver-Dependent Flags

These are solver-dependent flags the interpretation of which depends on the program that created the neutral file and the program used to read the neutral file.

Format: `(10I8)`

Variable	*Description*
`(ISOLVE(I),I=1,NFLAGS)`	Solver-dependent flags

Records 4 to NELGP+4—Element Records

Each element group requires a separate record, therefore the file should include NELGP records of the following form.

Format: `(10I8)`

Variable	*Description*
`(NELT(I),I=1,NELGP)`	Global/element/cell number of the I^{th} element/ cell in the group

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Boundary Conditions Sets (*Optional*)

This section identifies and labels points, edges, and/or faces to which boundary conditions are to be applied. Each set of boundary conditions is preceded by a header and control record.

There are two types of boundary-condition sets. One provides a list of grid points; the other provides a list of element/cell faces.

Header Record Descriptor

```
BOUNDARY CONDITIONS
```

Record 1—Boundary Condition Control Record

Format: `(A32, 8I10)`

Variable	*Description*
NAME	Name of boundary-condition set
ITYPE	Data type (0 = node; 1 = element/cell)
NENTRY	Number of data records in boundary-condition set
NVALUES	Number of values for each data record
IBCODE1	(*Optional*) Boundary condition code 1
IBCODE2	(*Optional*) Boundary condition code 2
IBCODE3	(*Optional*) Boundary condition code 3
IBCODE4	(*Optional*) Boundary condition code 4
IBCODE5	(*Optional*) Boundary condition code 5

All of the IBCODE entries listed above are optional and program-dependent. The following table lists the IBCODE1 values that correspond to various boundary-entity types.

IBCODE1 Value	*Boundary Entity Type*
0	UNSPECIFIED
1	AXIS
2	CONJUGATE
3	CONVECTION
4	CYCLIC
5	DEAD
6	ELEMENT_SIDE
7	ESPECIES
8	EXHAUST_FAN
9	FAN
10	FREE_SURFACE
11	GAP
12	INFLOW
13	INLET
14	INLET_VENT
15	INTAKE_FAN
16	INTERFACE
17	INTERIOR
18	INTERNAL

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IBCODE1 Value	*Boundary Entity Type*
19	LIVE
20	MASS_FLOW_INLET
21	MELT
22	MELT_INTERFACE
23	MOVING_BOUNDARY
24	NODE
25	OUTFLOW
26	OUTLET
27	OUTLET_VENT
28	PERIODIC
29	PLOT
30	POROUS
31	POROUS_JUMP
32	PRESSURE
33	PRESSURE_FAR_FIELD
34	PRESSURE_INFLOW
35	PRESSURE_INLET
36	PRESSURE_OUTFLOW
37	PRESSURE_OUTLET
38	RADIATION
39	RADIATOR

IBCODE1 Value	*Boundary Entity Type*
40	RECIRCULATION_INLET
41	RECIRCULATION_OUTLET
42	SLIP
43	SREACTION
44	SURFACE
45	SYMMETRY
46	TRACTION
47	TRAJECTORY
48	VELOCITY
49	VELOCITY_INLET
50	VENT
51	WALL
52	SPRING

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Records 2 to NENTRY

The format for the remainder of records in this section depends on the value of the data type variable (`ITYPE`) on Record 1 as follows.

Nodal Data (ITYPE=0)

Format: `(I10/ (4E20.12))`

Variable	*Description*
`NODE`	Node number
`(VALUES(I),I=1,NVALUES)`	Nodal values

Element/Cell Data (ITYPE=1)

Format: `(I10, I5/ (4E20.12))`

Variable	*Description*
`ELEM`	Element/cell number
`ELEMENT TYPE`	Element type
`FACE`	Face number (see Section C.2 for face-numbering conventions)
`(VALUES(I),I=1,NVALUES)`	Element/cell values

Non-Conformal Mesh Data (*Optional*)

This section includes data on non-conformal mesh elements. This section can also appear in the solution-data section for the case when the non-conformal data is changing with the solution or even at every time step (for example, in a contact problem or a sliding-mesh problem)

Each set data is preceded by a header and control record.

Header Record Descriptor

```
FACE CONNECTIVITY
```

Record 1—Non-Conformal Mesh Control Record

Format: `(I10)`

Variable	*Description*
NFACE	Number of face connectivity data records

Records 2 to NFACE+1—Non-Conformal Mesh Data Record

The following record is repeated NFACE times in this section.

Format: `(I10, I1, I2, NFACES*(I9, I1))`

where NFACES is the number of element faces abutting the master element face.

Variable	*Description*
MELEM	Master element number
MFACE	Master element face number
NFACES	Number of element faces abutting master element face
NELEM	Element number of abutting element
NFACE	Element face number

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Solution Vectors (*Optional*)

This section is repeated for each time step. For a steady-state analysis, only one "time step" is present and KSTEP=1, TIME=0, and DT=0.

Solution vector records can appear in any order. Each solution vector must be preceded by the appropriate header record as described below. All headers are 20 characters in length. There are three basic types of solution vectors: scalar, vector, and tensor.

Each time step is bracketed by a header record consisting of the 20 character descriptor "`TIMESTEPDATA`" followed by a neutral-file version number. (NOTE: These data are entered in the Fortran-style format (A20,F10.3).) Each section ends with a record with the string "`ENDOFTIMESTEP`".

Record 1—Time-Step Control Information Record

Format: `('TIMESTEP: ',I5,' TIME: ',E15.7,' INCRMNT: ',E15.7)`

Variable	*Description*
`KSTEP`	Time-step number
`TIME`	Time value of time step
`DT`	Time-step increment

Record 2—Vector/Tensor Solution Record

Format: `(A20,3I5)`

Variable	*Description*
`RECORDTYPE`	20-character descriptor starting in column 1 Example vector/tensor `RECORDTYPE` values are: `VELOCITY` (velocity vector data) `COORDINATE` (coordinate data for a moving-mesh problem)
`ICELL`	Data basis type: 0 = node-based data 1 = cell-based data 2 = group-based data
`IVECT`	Data type: 0 = scalar data 1 = vector data 2 = tensor data
`NVECT`	Number of data values: Scalar data = 1 Vector/tensor data = N (NOTE: Vector data should default to NDFVL.)

Records 3 to End of Section—Vector/Tensor Solution Record

Format: `(I10,3E20.12/(4E20.12)`

Variable	*Description*
`ND`	Node/element/group number
`VAL(I),I=1,NVECT)`	Vector components

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Record 2—Scalar Solution Record

Format: (A20,3I5)

Variable	*Description*
RECORDTYPE	20-character descriptor starting in column 1 Example scalar RECORDTYPE values are: TEMPERATURE (temperature data) KINETIC ENERGY (turbulent kinetic energy data) DISSIPATION (turbulent dissipation data) SPECIES nn (species nn data) DENSITY (density data)
ICELL	Data basis type: 0 = node-based data 1 = cell-based data 2 = group-based data
IVECT	Data type: 0 = scalar data 1 = vector data 2 = tensor data
NVECT	Number of data values: Scalar data = 1 Vector/tensor data = N (NOTE: Vector data should default to NDFVL.)

Records 3 to (End of Section-1)—Scalar Solution Record

Format: (I10,E20.12)

Variable	*Description*
ND	Node/element/group number
VAL	Scalar value at node/element ND

End of Section Record—Time-Step Termination Record

Format: ('ENDOFTIMESTEP')

C.2 Element Type and Node-Numbering Conventions

This section summarizes node-numbering conventions for GAMBIT neutral files. Each subsection includes a description and graphical representation of an edge, face, or volume element. Face- and volume-element subsections also include node-numbering definitions for edges and faces.

C.2.1 Edge, 2-Node

Description

Linear edge element.

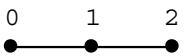
Graphical Representation

C.2.2 Edge, 3-Node

Description

Edge element with mid-edge node.

Graphical Representation



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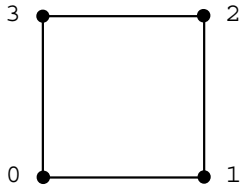
C.2.3 Quad, 4-Node

Description

Linear quadrilateral element.

Graphical Representation



Edge Definitions

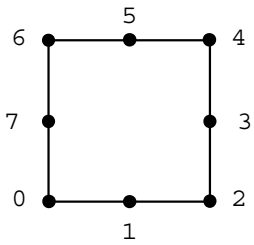
Edge	*Nodes*
1	0,1
2	1,2
3	2,3
4	3,0

C.2.4 Quad, 8-Node

Description

Quadrilateral element with mid-edge nodes.

Graphical Representation



Edge Definitions

Edge	*Nodes*
1	0,1,2
2	2,3,4
3	4,5,6
4	6,7,0

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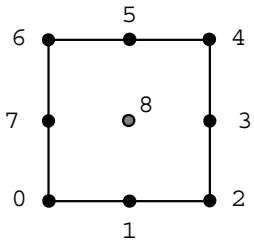
C.2.5 Quad, 9-Node

Description

Quadrilateral element with mid-edge nodes and mid-face node.

Graphical Representation



Edge Definitions

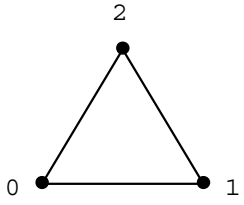
Edge	*Nodes*
1	0,1,2
2	2,3,4
3	4,5,6
4	6,7,0

C.2.6 Triangle, 3-Node

Description

Linear triangular element.

Graphical Representation



Edge Definitions

Edge	*Nodes*
1	0,1
2	1,2
3	2,0

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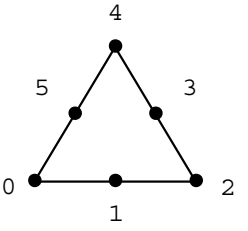
C.2.7 Triangle, 6-Node

Description

Triangular element with mid-edge nodes.

Graphical Representation



Edge Definitions

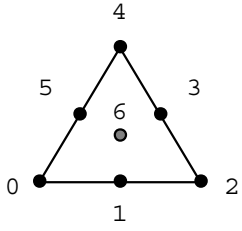
Edge	*Nodes*
1	0,1,2
2	2,3,4
3	4,5,0

C.2.8 Triangle, 7-Node

Description

Triangular element with mid-edge nodes and mid-face node.

Graphical Representation



Edge Definitions

Edge	*Nodes*
1	0,1,2
2	2,3,4
3	4,5,0

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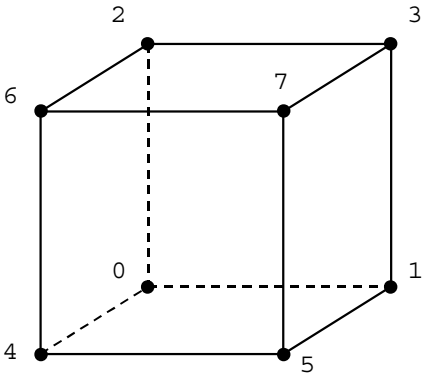
C.2.9 Brick, 8-Node

Description

Linear brick element.

Graphical Representation



Edge and Face Definitions

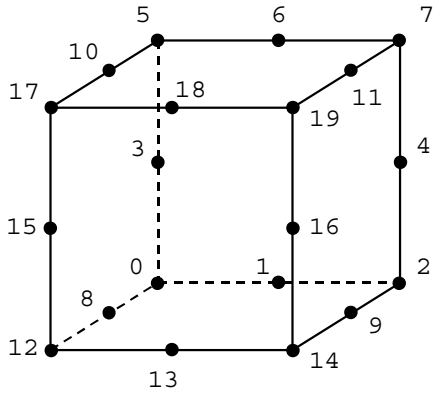
Edge	*Nodes*	*Face*	*Nodes*
1	0,4	1	0,1,5,4
2	0,1	2	1,3,7,5
3	1,5	3	3,2,6,7
4	4,5	4	2,0,4,6
5	1,3	5	1,0,2,3
6	3,7	6	4,5,7,6
7	5,7		
8	2,3		
9	2,6		
10	6,7		
11	0,2		
12	4,6		

C.2.10 Brick, 20-Node

Description

Brick element with mid-edge nodes.

Graphical Representation



Edge and Face Definitions

Edge	*Nodes*	*Face*	*Nodes*
1	0,8,12	1	0,1,2,9,14,13,12,8
2	0,1,2	2	2,4,7,11,19,16,14,9
3	2,9,14	3	7,6,5,10,17,18,19,11
4	12,13,14	4	5,3,0,8,12,15,17,10
5	2,4,7	5	2,1,0,3,5,6,7,4
6	7,11,19	6	12,13,14,16,19,18,17,15
7	14,16,19		
8	5,6,7		
9	5,10,17		
10	17,18,19		
11	0,3,5		
12	12,15,17		

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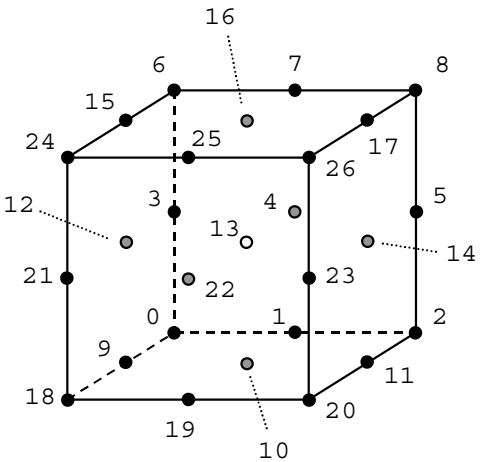
C.2.11 Brick, 27-Node

Description

Brick element with mid-edge nodes, mid-face nodes, and center node.

Graphical Representation



Edge and Face Definitions

(NOTE: Numbers in brackets indicate mid-face nodes.)

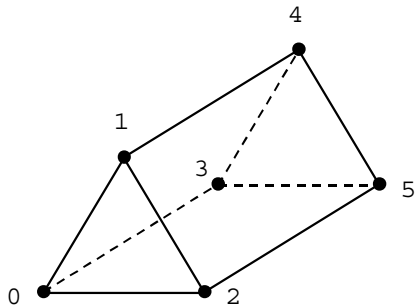
Edge	*Nodes*	*Face*	*Nodes*
1	0,9,18	1	0,1,2,11,20,19,18,9,(10)
2	0,1,2	2	2,5,8,17,26,23,20,11,(14)
3	2,11,20	3	8,7,6,15,24,25,26,17,(16)
4	18,19,20	4	6,3,0,9,18,21,24,15,(12)
5	2,5,8	5	2,1,0,3,6,7,8,5,(4)
6	8,17,26	6	18,19,20,23,26,25,24,21,(22)
7	20,23,26		
8	6,7,8		
9	6,15,24		
10	24,25,26		
11	0,3,6		
12	18,21,24		

C.2.12 Wedge, 6-Node

Description

Linear wedge element.

Graphical Representation



Edge and Face Definitions

Edge	*Nodes*	*Face*	*Nodes*
1	0,1	1	0,1,4,3
2	1,2	2	1,2,5,4
3	2,0	3	2,0,3,5
4	3,4	4	0,2,1
5	4,5	5	3,4,5
6	5,3		
7	0,3		
8	1,4		
9	2,5		

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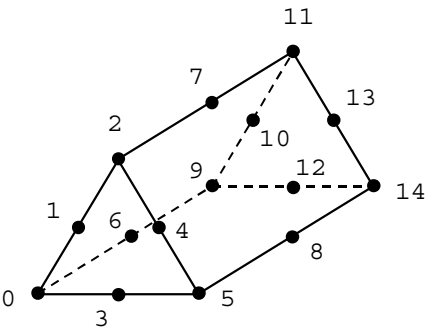
C.2.13 Wedge, 15-Node

Description

Wedge element with mid-edge nodes.

Graphical Representation



Edge and Face Definitions

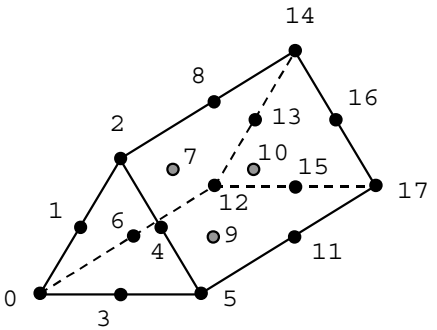
Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,1,2,7,11,10,9,6
2	2,4,5	2	2,4,5,8,14,13,11,7
3	5,3,0	3	5,3,0,6,9,12,14,8
4	9,10,11	4	0,3,5,4,2,1
5	11,13,14	5	9,10,11,13,14,12
6	14,12,9		
7	0,6,9		
8	2,7,11		
9	5,8,14		

C.2.14 Wedge, 18-Node

Description

Wedge element with mid-edge nodes and mid-face nodes on rectangular faces.

Graphical Representation



Edge and Face Definitions

(NOTE: Numbers in brackets indicate mid-face nodes.)

Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,1,2,8,14,13,12,6,(7)
2	2,4,5	2	2,4,5,11,17,16,14,8,(10)
3	5,3,0	3	5,3,0,6,12,15,17,11,(9)
4	12,13,14	4	0,3,5,4,2,1
5	14,16,17	5	12,13,14,16,17,15
6	17,15,12		
7	0,6,12		
8	2,8,14		
9	5,11,17		

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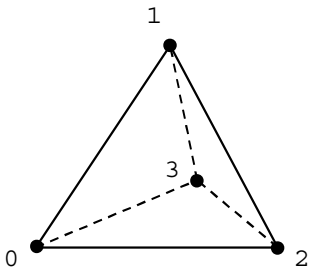
C.2.15 Tetrahedron, 4-Node

Description

Linear tetrahedral element.

Graphical Representation



Edge and Face Definitions

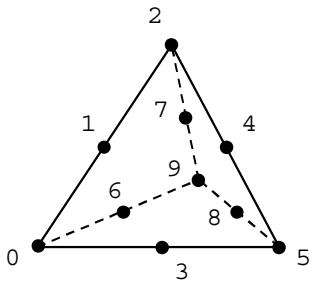
Edge	*Nodes*	*Face*	*Nodes*
1	0,1	1	1,0,2
2	1,2	2	0,1,3
3	2,0	3	1,2,3
4	0,3	4	2,0,3
5	1,3		
6	2,3		

C.2.16 Tetrahedron, 10-Node

Description

Tetrahedral element with mid-edge nodes.

Graphical Representation



Edge and Face Definitions

Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	2,1,0,3,5,4
2	2,4,5	2	0,1,2,7,9,6
3	5,3,0	3	2,4,5,8,9,7
4	0,6,9	4	5,3,0,6,9,8
5	2,7,9		
6	5,8,9		

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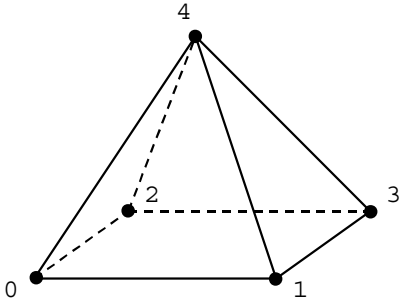
C.2.17 Pyramid, 5-Node

Description

Linear pyramidal element.

Graphical Representation



Edge and Face Definitions

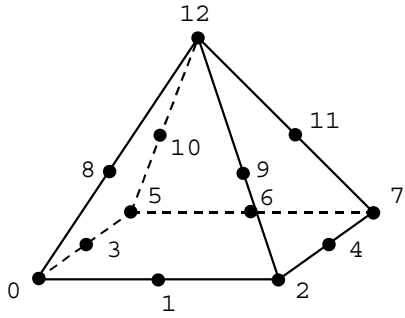
Edge	*Nodes*	*Face*	*Nodes*
1	0,1	1	0,2,3,1
2	1,3	2	0,1,4
3	3,2	3	1,3,4
4	2,0	4	3,2,4
5	0,4	5	2,0,4
6	1,4		
7	3,4		
8	2,4		

C.2.18 Pyramid, 13-Node

Description

Pyramidal element with mid-edge nodes.

Graphical Representation



Edge and Face Definitions

Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,3,5,6,7,4,2,1
2	2,4,7	2	0,1,2,9,12,8
3	7,6,5	3	2,4,7,11,12,9
4	5,3,0	4	7,6,5,10,12,11
5	0,8,12	5	5,3,0,8,12,10
6	2,9,12		
7	7,11,12		
8	5,10,12		

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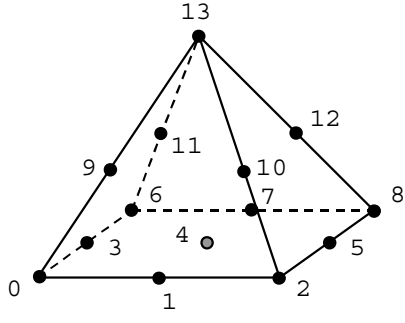
C.2.19 Pyramid, 14-Node

Description

Pyramidal element with mid-edge nodes and mid-face node on rectangular face.

Graphical Representation



Edge and Face Definitions

(NOTE: Numbers in brackets indicate mid-face nodes.)

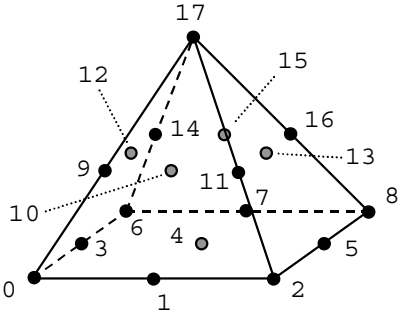
Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,3,6,7,8,5,2,1,(4)
2	2,5,8	2	0,1,2,10,13,9
3	8,7,6	3	2,5,8,12,13,10
4	6,3,0	4	8,7,6,11,13,12
5	0,9,13	5	6,3,0,9,13,11
6	2,10,13		
7	8,12,13		
8	6,11,13		

C.2.20 Pyramid, 18-Node

Description

Pyramidal element with mid-edge nodes and mid-face nodes on all faces.

Graphical Representation



Edge and Face Definitions

(NOTE: Numbers in brackets indicate mid-face nodes.)

Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,3,6,7,8,5,2,1,(4)
2	2,5,8	2	0,1,2,11,17,9,(10)
3	8,7,6	3	2,5,8,16,17,11,(13)
4	6,3,0	4	8,7,6,14,17,16,(15)
5	0,9,17	5	6,3,0,9,17,14,(12)
6	2,11,17		
7	8,16,17		
8	6,14,17		

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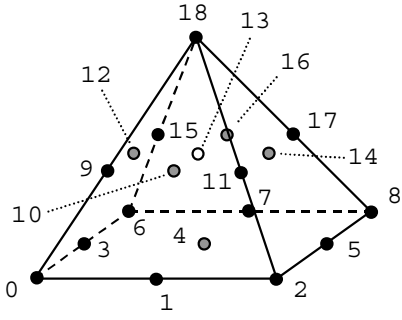
C.2.21 Pyramid, 19-Node

Description

Pyramidal element with mid-edge nodes, mid-face nodes, and a center node.

Graphical Representation



Edge and Face Definitions

(NOTE: Numbers in brackets indicate mid-face nodes.)

Edge	*Nodes*	*Face*	*Nodes*
1	0,1,2	1	0,3,6,7,8,5,2,1,(4)
2	2,5,8	2	0,1,2,11,18,9,(10)
3	8,7,6	3	2,5,8,17,18,11,(14)
4	6,3,0	4	8,7,6,15,18,17,(16)
5	0,9,18	5	6,3,0,9,18,15,(12)
6	2,11,18		
7	8,17,18		
8	6,15,18		

C.3 Example GAMBIT Neutral File

The following GAMBIT neutral file illustrates the data formats described in Section C.1, above.

```
        CONTROL INFO 1.2.1
** GAMBIT NEUTRAL FILE
Example
PROGRAM:                Gambit      VERSION:  1.2.1
 4 Jan 2000    13:07:49
     NUMNP      NELEM      NGRPS     NBSETS      NDFCD      NDFVL
        60        116          1          2          3          3
ENDOFSECTION
   NODAL COORDINATES 1.2.1
         1    5.0000000000e+00    5.0000000000e+00    5.0000000000e+00
         2    5.0000000000e+00    5.0000000000e+00   -5.0000000000e+00
         3    5.0000000000e+00    5.0000000000e+00    0.0000000000e+00
         4   -5.0000000000e+00    5.0000000000e+00   -5.0000000000e+00
         5    0.0000000000e+00    5.0000000000e+00   -5.0000000000e+00
         6   -5.0000000000e+00    5.0000000000e+00    5.0000000000e+00
         7   -5.0000000000e+00    5.0000000000e+00    0.0000000000e+00
         8    0.0000000000e+00    5.0000000000e+00    5.0000000000e+00
         9    0.0000000000e+00    5.0000000000e+00    0.0000000000e+00
        10    5.0000000000e+00   -5.0000000000e+00    5.0000000000e+00
        11    5.0000000000e+00   -5.0000000000e+00   -5.0000000000e+00
        12    5.0000000000e+00   -5.0000000000e+00    0.0000000000e+00
        13    5.0000000000e+00    4.0000000000e+00   -5.0000000000e+00
        14    5.0000000000e+00    3.0000000000e+00   -5.0000000000e+00
        15    5.0000000000e+00   -1.0000000000e+00   -5.0000000000e+00
        16    5.0000000000e+00   -1.0000000000e+00    5.0000000000e+00
        17    5.0000000000e+00    3.0000000000e+00    5.0000000000e+00
        18    5.0000000000e+00    4.0000000000e+00    5.0000000000e+00
        19    5.0000000000e+00    4.0000000000e+00    0.0000000000e+00
        20    5.0000000000e+00    3.0000000000e+00    0.0000000000e+00
        21    5.0000000000e+00   -1.0000357386e+00   -2.1429854082e+00
        22    5.0000000000e+00   -1.0000142940e+00    2.1428045712e+00
        23   -5.0000000000e+00   -5.0000000000e+00   -5.0000000000e+00
        24   -5.0000000000e+00   -1.0000000000e+00   -5.0000000000e+00
        25   -5.0000000000e+00    3.0000000000e+00   -5.0000000000e+00
        26   -5.0000000000e+00    4.0000000000e+00   -5.0000000000e+00
        27   -5.0000000000e+00   -5.0000000000e+00    5.0000000000e+00
        28   -5.0000000000e+00   -5.0000000000e+00    0.0000000000e+00
        29   -5.0000000000e+00    4.0000000000e+00    5.0000000000e+00
        30   -5.0000000000e+00    3.0000000000e+00    5.0000000000e+00
        31   -5.0000000000e+00   -1.0000000000e+00    5.0000000000e+00
        32   -5.0000000000e+00    4.0000000000e+00    0.0000000000e+00
        33   -5.0000000000e+00    3.0000000000e+00    0.0000000000e+00
        34   -5.0000000000e+00   -9.9998719326e-01   -2.1429802624e+00
        35   -5.0000000000e+00   -9.9999471598e-01    2.1428065305e+00
        36    0.0000000000e+00   -5.0000000000e+00   -5.0000000000e+00
        37    0.0000000000e+00   -5.0000000000e+00    5.0000000000e+00
        38   -1.4289352978e+00   -5.0000000000e+00    1.4308811671e+00
        39    1.9997758876e+00   -5.0000000000e+00    2.0015626884e+00
        40    1.4283714321e+00   -5.0000000000e+00   -1.4272124905e+00
        41   -2.0001422982e+00   -5.0000000000e+00   -1.9990784374e+00
        42    0.0000000000e+00    4.0000000000e+00   -5.0000000000e+00
        43    0.0000000000e+00    3.0000000000e+00   -5.0000000000e+00
        44    2.1429802623e+00   -9.9998719322e-01   -5.0000000000e+00
        45   -2.1428065305e+00   -9.9999471596e-01   -5.0000000000e+00
        46    0.0000000000e+00    4.0000000000e+00    5.0000000000e+00
        47    0.0000000000e+00    3.0000000000e+00    5.0000000000e+00
        48   -2.1429802624e+00   -9.9998719326e-01    5.0000000000e+00
        49    2.1428065305e+00   -9.9999471598e-01    5.0000000000e+00
        50    4.4312134385e-01   -2.6634261608e+00    3.1294517517e+00
        51    3.1295456886e+00   -2.6647951603e+00    4.4566029310e-01
        52    5.1142787933e-01   -2.6999440193e+00   -3.1325452328e+00
        53    1.3718595728e-03   -1.0109794140e+00    2.7755575616e-16
        54    3.4559090137e+00   -3.2225546837e+00   -3.4559490681e+00
        55    0.0000000000e+00    3.0000000000e+00    0.0000000000e+00
```

```
        56   -2.5000000000e+00   -5.3553391000e-01    2.5000000000e+00
        57    2.5000000000e+00   -5.3553391000e-01   -2.5000000000e+00
        58   -2.5000000000e+00   -5.3553391000e-01   -2.5000000000e+00
        59    2.5000000000e+00   -5.3553391000e-01    2.5000000000e+00
        60    0.0000000000e+00    4.0000000000e+00    0.0000000000e+00
ENDOFSECTION
      ELEMENTS/CELLS 1.2.1
       1  4  8         7       4       9       5      32      26      60
                     42
       2  4  8         6       7       8       9      29      32      46
                     60
       3  4  8         9       5       3       2      60      42      19
                     13
       4  4  8         8       9       1       3      46      60      18
                     19
       5  4  8        32      26      60      42      33      25      55
                     43
       6  4  8        29      32      46      60      30      33      47
                     55
       7  4  8        60      42      19      13      55      43      20
                     14
       8  4  8        46      60      18      19      47      55      17
                     20
       9  7  5        33      25      55      43      58
      10  7  5        30      33      47      55      56
      11  7  5        55      43      20      14      57
      12  7  5        47      55      17      20      59
      13  6  4        59      49      47      56
      14  6  4        59      55      56      47
      15  6  4        59      47      49      17
      16  6  4        59      22      20      17
      17  6  4        59      22      57      20
      18  6  4        59      20      57      55
      19  6  4        59      39      22      49
      20  6  4        47      49      48      56
      21  6  4        47      48      30      56
      22  6  4        33      25      58      34
      23  6  4        33      35      34      58
      24  6  4        33      35      58      56
      25  6  4        33      56      58      55
      26  6  4        33      30      35      56
      27  6  4        14      44      57      43
      28  6  4        14      21      20      57
      29  6  4        27      35      38      28
      30  6  4        27      31      48      35
      31  6  4        27      48      37      38
      32  6  4        36      23      41      45
      33  6  4        44      57      43      45
      34  6  4        22      20      21      57
      35  6  4        22      16      49      10
      36  6  4        22      49      39      10
      37  6  4        35      34      58      28
      38  6  4        58      43      57      45
      39  6  4        58      55      57      43
      40  6  4        58      43      45      25
      41  6  4        58      34      41      28
      42  6  4        58      41      38      28
      43  6  4        58      45      41      34
      44  6  4        24      45      34      23
      45  6  4        41      34      45      23
      46  6  4        41      28      34      23
      47  6  4        17      49      22      16
      48  6  4        17      49      59      22
      49  6  4        35      31      48      30
      50  6  4        35      30      48      56
      51  6  4        21      14      44      57
      52  6  4        21      15      44      14
      53  6  4        38      35      48      56
      54  6  4        38      35      27      48
      55  6  4        58      56      35      38
      56  6  4        58      38      35      28
```

```
      57  6  4        34       45       24       25
      58  6  4        34       25       58       45
      59  6  4        50       38       39       37
      60  6  4        50       39       59       49
      61  6  4        50       49       59       56
      62  6  4        50       48       49       56
      63  6  4        50       49       48       37
      64  6  4        50       38       48       56
      65  6  4        50       37       48       38
      66  6  4        51       39       40       12
      67  6  4        51       59       39       22
      68  6  4        51       57       59       22
      69  6  4        51       57       22       21
      70  6  4        51       21       22       12
      71  6  4        52       58       57       45
      72  6  4        52       41       58       45
      73  6  4        52       45       36       41
      74  6  4        52       57       44       45
      75  6  4        52       45       44       36
      76  6  4        52       36       40       41
      77  6  4        53       50       59       56
      78  6  4        53       58       38       56
      79  6  4        53       38       50       56
      80  6  4        53       52       51       40
      81  6  4        53       40       51       39
      82  6  4        53       40       38       41
      83  6  4        53       41       52       40
      84  6  4        53       39       38       40
      85  6  4        53       39       50       38
      86  6  4        53       58       41       38
      87  6  4        53       58       52       41
      88  6  4        53       51       52       57
      89  6  4        53       52       58       57
      90  6  4        53       58       56       55
      91  6  4        53       59       55       56
      92  6  4        53       59       51       57
      93  6  4        53       58       55       57
      94  6  4        53       59       57       55
      95  6  4        54       21       44       57
      96  6  4        54       44       52       57
      97  6  4        54       36       44       11
      98  6  4        54       36       52       44
      99  6  4        54       15       44       21
     100  6  4        54       15       21       11
     101  6  4        54       44       15       11
     102  6  4        54       40       36       11
     103  6  4        54       52       36       40
     104  6  4        54       51       52       40
     105  6  4        54       52       51       57
     106  6  4        54       57       51       21
     107  6  4        54       12       51       40
     108  6  4        54       21       51       12
     109  6  4        54       12       40       11
     110  6  4        54       21       12       11
     111  6  4        37       39       49       10
     112  6  4        37       39       50       49
     113  6  4        53       50       39       59
     114  6  4        53       39       51       59
     115  6  4        22       39       12       10
     116  6  4        22       39       51       12
ENDOFSECTION
      ELEMENT GROUP 1.2.1
GROUP:          1 ELEMENTS:        116 MATERIAL:          2 NFLAGS:          1
                        fluid
       0
       1        2        3        4        5        6        7        8        9       10
      11       12       13       14       15       16       17       18       19       20
      21       22       23       24       25       26       27       28       29       30
      31       32       33       34       35       36       37       38       39       40
      41       42       43       44       45       46       47       48       49       50
      51       52       53       54       55       56       57       58       59       60
```

```
      61      62      63      64      65      66      67      68      69      70
      71      72      73      74      75      76      77      78      79      80
      81      82      83      84      85      86      87      88      89      90
      91      92      93      94      95      96      97      98      99     100
     101     102     103     104     105     106     107     108     109     110
     111     112     113     114     115     116
ENDOFSECTION
 BOUNDARY CONDITIONS 1.2.1
                  element_side.1       1      14       0       6
         3     4     3
         4     4     3
         7     4     3
         8     4     3
       100     6     3
       110     6     3
       115     6     4
        35     6     2
        47     6     4
        16     6     3
        28     6     1
        52     6     2
        34     6     1
        70     6     3
ENDOFSECTION
 BOUNDARY CONDITIONS 1.2.1
                          node.2       0      16       0      24
        27
        23
         4
         6
        29
        30
        31
        28
        24
        25
        26
         7
        32
        33
        34
        35
ENDOFSECTION
```