

# Supplement to “Preferences in College Applications – a Nonparametric Bayesian Analysis of Top-10 Rankings.”

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# 1 Derivation of Algorithm for Estimation of a Finite Mixture of Infinite Generalized Mallows' Models.

The infinite generalized Mallows' model (Meilă & Chen, 2010) is given by

$$\text{IGM}(\pi; \sigma, \boldsymbol{\theta}) = \frac{1}{Z(\boldsymbol{\theta})} \exp(-\boldsymbol{\theta}^T \mathbf{s}(\pi|\sigma))$$

where  $\pi$  is a ranking;  $\sigma$  is a location parameter, which we refer to as the *central ranking*;  $\boldsymbol{\theta}$  is a vector of dispersion parameters  $(\theta_1, \dots, \theta_{n-1})$ , where  $n$  is the number of items in  $\pi$ ;  $\mathbf{s}(\pi|\sigma) = (s_1, \dots, s_{n-1})$ , where  $s_j = \sum_{i=1}^{n-1} I(\pi^{-1}(j) \prec \sigma^{-1}(i))$ ,  $\pi^{-1}(j)$  is the item ranked by  $\pi$  at position  $j$ ,  $\prec$  means “precedes,” and  $I(\cdot)$  is the indicator function; and  $Z(\boldsymbol{\theta})$  is a normalization constant equal to

$$\prod_{j=1}^{n-1} \psi(\theta_j) = \prod_{j=1}^{n-1} \frac{1 - \exp(-((n-j+1)\theta_j))}{1 - \exp(-\theta_j)}.$$

$\mathbf{s}(\pi|\sigma)$  is, in other words, the number of items ranked by  $\pi$  ahead of  $\sigma$ .

If we have  $K$  IGM models, indexed by  $k$ , and each parameterized by  $(\sigma_k, \boldsymbol{\theta}_k)$ , then we can use the E-M algorithm to estimate the parameters of these models given some observed rankings  $\mathcal{D} = \{\pi_1, \dots, \pi_N\}$ .

The expected complete data log likelihood in this case is

$$\mathcal{L}(\sigma_1, \dots, \sigma_K, \boldsymbol{\theta}_1, \dots, \boldsymbol{\theta}_K, p_1, \dots, p_K) = \sum_{i=1}^N \sum_{k=1}^K P(c_i = k | \pi_i; \sigma_k, \boldsymbol{\theta}_k) \ln \frac{P(\pi_i | c_i = k; \sigma_k, \boldsymbol{\theta}_k) P(c_i = k; p_k)}{P(c_i = k | \pi_i; \sigma_k, \boldsymbol{\theta}_k)}$$

where  $c_i$  is a latent variable representing the assignment of data point  $\pi_i$  to cluster  $k$ , and  $p_k$  is the mixing proportion of cluster  $k$ .

Writing  $P(c_i = k | \pi_i; \sigma_k, \boldsymbol{\theta}_k)$  as  $p_{ik}$ , and expanding  $\mathcal{L}$  gives

$$- \sum_i \sum_k p_{ik} \sum_j [\theta_{kj} s_j(\pi_i | \sigma_k) + \ln \psi(\theta_{kj})].$$

Theorem 1 in (Meilă & Bao, 2008) allows us to write this as

$$-\sum_i \sum_k \sum_j [\theta_{kj} L_{\sigma_k}(\mathbf{R}_{\mathbf{k}j}) + N_{kj} \ln \psi(\theta_{kj})]$$

where  $L_{\sigma}(\mathbf{M})$  is the sum of the lower triangle of  $\mathbf{M}$  with the rows and columns of  $\mathbf{M}$  permuted by  $\sigma$ ;  $\mathbf{R}_{\mathbf{k}j}$  is a matrix with its entries indexed by  $(a, b)$  and given by  $R_{kj,ab} = \sum_i p_{ik} I(\pi_i^{-1}(j) = a \text{ and } b \prec_{\pi_i} a)$ , where  $\prec_{\pi}$  means precedes in  $\pi$ ; and  $N_{kj} = \sum_i p_{ik} I(t_i \geq j)$ , and  $t_i$  is the length of ranking  $\pi_i$ .  $R_{kj,ab}$  is, in other words, the number of times item  $a$  is ranked at position  $j$  in  $\pi_i$  but is preceded by  $b$ , weighted by  $p_{ik}$ , summed over  $\mathcal{D}$ .  $N_{kj}$  is the number of rankings in  $\mathcal{D}$  with length greater than or equal to  $j$ , weighted by  $p_{ik}$ .

Maximizing  $\mathcal{L}$  is equivalent to minimizing  $-\mathcal{L}$ , and can hence be accomplished by the following alternating minimization algorithm:

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initialize:  $\theta_{kj} = 1, \forall j, k$ 
while not converged do
  for  $k = 1$  to  $K$  clusters do
    compute  $\mathbf{R}_{\mathbf{k}} = \sum_j \theta_{kj}^- \mathbf{R}_{\mathbf{k}j}$ , where  $\theta_{kj}^-$  denotes the estimate of  $\theta_{kj}$  from the previous iteration
    estimate  $\sigma_k$  by Algorithm BBOUND $\mathbf{R}$  (Meilă & Bao, 2008), using  $\mathbf{R}_{\mathbf{k}}$ 
    for  $j = 1$  to  $n - 1$  do
      estimate  $\theta_{jk} = \ln[1 + N_{kj}/L_{\sigma_k}(\mathbf{R}_{\mathbf{k}j})]$ 
    end for
  end for
end while

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## 2 Table 1: Results with Dirichlet Process Mixture of Generalized Mallows' Models.

$N_k$  denotes the size of cluster  $k$ .

Cluster number, $N_k$	Rank	Central ranking $\sigma_k$ , dispersions $\theta_k$	Description
<b>Cluster 1</b> , label 19, $N_k = 4536$ , 8%		$\theta_k = (1.48, 1.54, 1.40, 1.23, 1.06, 0.95, 0.80, 0.69, 0.58, 0.46)$	
	1	Computer Applications (Dub. City U.)	Definitely a Computer Science/Engineering cluster. Also dominated by Dublin colleges Theta stays high for all values Males make up 75% of the members Average points relatively low (368) Choices pretty uniform between 1 and 9 with a spike at 10 (35%).
	2	Computer Science (U. Coll. Dub.)	
	3	Engineering (U. Coll. Dub.)	
	4	Computer Science (Tri. Coll. Dub.)	
	5	Engineering (Tri. Coll. Dub.)	
	6	Computer Science (NUI - Maynooth)	
	7	Computer Science (Dub. Inst. of Tech.)	
	8	Science (U. Coll. Dub.)	
	9	Applied Sciences/Computing (Dub. Inst. of Tech.)	
	10	Engineering (Dub. Inst. of Tech.)	
	11	Information & Comm. Tech. (Tri. Coll. Dub.)	
	12	Software Systems (Nat. Coll. of Ire.)	
13	Computer Engineering (Dub. Inst. of Tech.)		
<b>Cluster 2</b> , label 7, $N_k = 4340$ , 8%		$\theta_k = (1.73, 1.81, 1.71, 1.48, 1.20, 0.99, 0.78, 0.60, 0.50, 0.35)$	
	1	Business Studies (Dub. Inst. of Tech.)	Definitely a business cluster. Dominated by Dublin colleges. The business courses are at the more applied end. Theta stays high for all values Quite balanced in terms of gender Average points relatively low (366) Choices pretty uniform between 1 and 9 with a spike at 10 (23%).
	2	Marketing (Dub. Inst. of Tech.)	
	3	Business Studies (Dub. City U.)	
	4	Admin & Marketing (Dub. Inst. of Tech.)	
	5	Commerce (U. Coll. Dub.)	
	6	Arts (U. Coll. Dub.)	
	7	Tourism Marketing (Dub. Inst. of Tech.)	
	8	Accounting/H.R.M. (Nat. Coll. of Ire.)	
	9	Retail & Services Management (Dub. Inst. of Tech.)	
	10	Computer Applications (Dub. City U.)	
	11	Business Info. Systems Development (Dub. Inst. of Tech.)	
12	Leisure Management (Dub. Inst. of Tech.)		
<b>Cluster 3</b> , label 164, $N_k = 4077$ , 8%		$\theta_k = (1.70, 1.66, 1.49, 1.26, 1.08, 0.91, 0.77, 0.62, 0.48, 0.35)$	
	1	Social Care (Dub. Inst. of Tech.)	A mixed Arts and Social Science cluster. This is not unusual because a lot of courses available in Arts degrees are social in nature (sociology, psychology, etc). Theta stays high for all values. Females make up 86% of members Average points low-ish (384) Choices pretty uniform between 1 and 9 with a spike at 10 (27%).
	2	Arts (U. Coll. Dub.)	
	3	Arts (NUI - Maynooth)	
4	Early Child Care and Education (Dub. Inst. of Tech.)		

	<ul style="list-style-type: none"> <li>5 Arts (NUI - Galway)</li> <li>6 Social Science (U. Coll. Dub.)</li> <li>7 Psychology (U. Coll. Dub.)</li> <li>8 Social Work (Tri. Coll. Dub.)</li> <li>9 Arts (U. Coll. Cork)</li> <li>10 Social Science (U. Coll. Cork)</li> <li>11 Psychology (NUI - Maynooth)</li> <li>12 Early Childhood Studies (U. Coll. Cork)</li> </ul>	
<p><b>Cluster 4</b>, label 12, <math>N_k = 3898</math>, 7%</p>	<ul style="list-style-type: none"> <li>1 Engineering (U. Coll. Dub.)</li> <li>2 Engineering (Undenominated) (NUI - Galway)</li> <li>3 Civil Engineering (NUI - Galway)</li> <li>4 Computer Systems (University of Limerick)</li> <li>5 Information Technology (University of Limerick)</li> <li>6 Engineering (Tri. Coll. Dub.)</li> <li>7 Engineering (Dub. Inst. of Tech.)</li> <li>8 Electronic Engineering (University of Limerick)</li> <li>9 Mechanical Engineering (University of Limerick)</li> <li>10 Computer Engineering (University of Limerick)</li> <li>11 Electronic &amp; Computer Engineering (NUI - Galway)</li> <li>12 Civial and Environmental Engineering (U. Coll. Cork)</li> <li>13 Mechanical Engineering (Cork IT)</li> </ul>	<p><math>\theta_k = (1.42, 1.40, 1.27, 1.15, 1.01, 0.85, 0.79, 0.67, 0.56, 0.46)</math></p> <p>Another engineering cluster. More geographically diverse than Cluster 19. Mainly courses outside Dublin but the Dublin engineering courses also prominent Theta stays high for all values. Males make up 85% of members Average points low-ish (373) Choices pretty uniform between 1 and 9 with a spike at 10 (35%).</p>
<p><b>Cluster 5</b>, label 11, <math>N_k = 3814</math>, 7%</p>	<ul style="list-style-type: none"> <li>1 Business Studies (University of Limerick)</li> <li>2 Commerce (NUI - Galway)</li> <li>3 Commerce (U. Coll. Cork)</li> <li>4 Arts (U. Coll. Cork)</li> <li>5 Business studies (Waterford IT)</li> <li>6 Arts (NUI - Galway)</li> <li>7 Public Administration (University of Limerick)</li> <li>8 Arts (University of Limerick)</li> <li>9 Accounting (U. Coll. Cork)</li> <li>10 Computer Systems (University of Limerick)</li> <li>11 Business Information Systems (U. Coll. Cork)</li> <li>12 Commerce (U. Coll. Dub.)</li> </ul>	<p><math>\theta_k = (1.71, 1.65, 1.57, 1.34, 1.23, 1.02, 0.86, 0.75, 0.62, 0.46)</math></p> <p>Another business cluster. The more general business courses very prominent. Dominated by courses outside Dublin. Theta stays high for all values. Gender balanced but more females. Average points high-ish (394) Choices pretty uniform between 1 and 9 with a spike at 10 (33%).</p>
<p><b>Cluster 6</b>, label 94, <math>N_k = 3106</math>, 6%</p>	<ul style="list-style-type: none"> <li>1 Arts (U. Coll. Cork)</li> <li>2 Business Information Systems (U. Coll. Cork)</li> </ul>	<p><math>\theta_k = (2.26, 2.14, 1.90, 1.64, 1.36, 0.99, 0.74, 0.58, 0.45, 0.35)</math></p> <p>The "Cork" cluster. Most of the courses are in the business/humanities/ social sciences. Some science courses too. Both UCC and CIT present and the non-Cork courses are in adjacent institutions (UL, LIT and WIT). Theta stays high for all values. Gender balanced. Average points high-ish (397) Choices pretty uniform between 1 and 9 with a spike at 10 (24%). Less uniform than usual</p>

	<ul style="list-style-type: none"> <li>3 Computer Science (U. Coll. Cork)</li> <li>4 Commerce (U. Coll. Cork)</li> <li>5 Computer Applications (Cork IT)</li> <li>6 Software Dev &amp; Comp Net (Cork IT)</li> <li>7 Law (U. Coll. Cork)</li> <li>8 Social Science (U. Coll. Cork)</li> <li>9 Biological and Chemical Sciences (U. Coll. Cork)</li> <li>10 Finance (U. Coll. Cork)</li> <li>11 Computer Systems (University of Limerick)</li> <li>12 Early Childhood Studies (U. Coll. Cork)</li> </ul>	
<b>Cluster 7</b> , label 54, $N_k = 3007$ , 6%	$\theta_k = (1.49, 1.48, 1.41, 1.33, 1.19, 0.94, 0.78, 0.58, 0.52, 0.39)$ <ul style="list-style-type: none"> <li>1 Science (U. Coll. Dub.)</li> <li>2 Science (NUI - Galway)</li> <li>3 Science (Tri. Coll. Dub.)</li> <li>4 Biological and Chemical Sciences (U. Coll. Cork)</li> <li>5 Science (NUI - Maynooth)</li> <li>6 Agricultural Science (U. Coll. Dub.)</li> <li>7 Biotechnology (Dub. City U.)</li> <li>8 Environmental Sciences (U. Coll. Cork)</li> <li>9 Arts (NUI - Galway)</li> <li>10 Environmental Sciences (NUI - Galway)</li> <li>11 Food Science (U. Coll. Cork)</li> <li>12 Science Common Entry (Dub. City U.)</li> <li>13 Biological Science with Phys/Chem Teach (University of Limerick)</li> </ul>	<p>Science cluster. No geographical basis. Biological slant. Theta stays high for all values. But less high than other clusters, indicated diversity. Twice as many females as males. Average points low-ish (370) Choices pretty uniform between 1 and 9 with a spike at 10 (32%).</p> <p>Science cluster. No geographical basis. Biological slant. Theta stays high for all values. But less high than other clusters, indicated diversity. Twice as many females as males. Average points</p>
<b>Cluster 8</b> , label 16, $N_k = 2868$ , 5%	$\theta_k = (2.36, 2.40, 2.07, 1.87, 1.57, 1.29, 1.14, 0.97, 0.74, 0.57)$ <ul style="list-style-type: none"> <li>1 Commerce (U. Coll. Dub.)</li> <li>2 Business and Legal Studies (U. Coll. Dub.)</li> <li>3 "Business, Economic and Social Studies (BESS)" (Tri. Coll. Dub.)</li> <li>4 Business Studies (Dub. City U.)</li> <li>5 Law (U. Coll. Dub.)</li> <li>6 Arts (U. Coll. Dub.)</li> <li>7 Business Studies (Dub. Inst. of Tech.)</li> <li>8 Law (Tri. Coll. Dub.)</li> <li>9 Bachelor of Civil Law (BCL) (NUI - Galway)</li> <li>10 Commerce (NUI - Galway)</li> <li>11 Corporate Law (NUI - Galway)</li> <li>12 Arts (NUI - Galway)</li> </ul>	<p>low-ish (370) Choices pretty uniform between 1 and 9 with a spike at 10 (32%).</p> <p>business courses are general rather than applied. Theta stays high for all values. Gender balanced. Average points high (430) Choices increasing slowly between 1 and 9 with a spike at 10 (49%).</p>
<b>Cluster 9</b> , label 178, $N_k = 2461$ , 5%	$\theta_k = (2.91, 2.70, 2.14, 1.80, 1.47, 1.20, 0.99, 0.78, 0.71, 0.51)$	<p>Medical and health courses. Theta lead by medical courses. Dentistry and other health courses follow. Also some biological sciences. Theta stays high for all values. Twice as many females as males. Average points very high (488) Uniform-ish between 1 and 9 with a spike at 10 (46%).</p>

	<ol style="list-style-type: none"> <li>1 Med. (U. Coll. Dub.)</li> <li>2 Med. (Tri. Coll. Dub.)</li> <li>3 Med. (NUI - Galway)</li> <li>4 Med. (U. Coll. Cork)</li> <li>5 Pharmacy (Tri. Coll. Dub.)</li> <li>6 Physiotherapy (U. Coll. Dub.)</li> <li>7 Science (U. Coll. Dub.)</li> <li>8 Physiotherapy (Tri. Coll. Dub.)</li> <li>9 Science (Tri. Coll. Dub.)</li> <li>10 Med. (Roy. Coll. of Surg.)</li> <li>11 Dental Science (Tri. Coll. Dub.)</li> <li>12 Veterinary Med. (U. Coll. Dub.)</li> </ol>	
<p><b>Cluster 10</b>, label 92, <math>N_k = 2422</math>, 5%</p>	$\theta_k = (2.87, 2.87, 2.13, 1.61, 1.32, 0.93, 0.76, 0.65, 0.50, 0.34)$ <ol style="list-style-type: none"> <li>1 Arts (U. Coll. Dub.)</li> <li>2 Arts (NUI - Maynooth)</li> <li>3 Communications - Film &amp; Broadcasting (Dub. Inst. of Tech.)</li> <li>4 Communications (Dub. City U.)</li> <li>5 Arts (NUI - Galway)</li> <li>6 Communications - Journalism (Dub. Inst. of Tech.)</li> <li>7 Journalism (Dub. City U.)</li> <li>8 Multimedia (Dub. City U.)</li> <li>9 Arts (U. Coll. Cork)</li> <li>10 Arts (University of Limerick)</li> <li>11 Psychology (U. Coll. Dub.)</li> <li>12 Psychology (NUI - Maynooth)</li> </ol>	<p>Arts degrees. Communications, Journalism and Social Sciences courses too. Theta stays high for all values. Twice as many females as males. Average points very high (402) Uniform-ish between 1 and 9 with a spike at 10 (29%).</p>
<p><b>Cluster 11</b>, label 15, <math>N_k = 2323</math>, 4%</p>	$\theta_k = (2.17, 1.75, 1.40, 1.05, 0.75, 0.50, 0.40, 0.28, 0.19, 0.11)$ <ol style="list-style-type: none"> <li>1 Qty. Surveying (Limerick IT)</li> <li>2 Construction Econ &amp; Mgt (Qty. Survey) (Dub. Inst. of Tech.)</li> <li>3 Construction Management (Galway-Mayo IT)</li> <li>4 Construction Management (Waterford IT)</li> <li>5 Building Management (Limerick IT)</li> <li>6 Valuation Surveying (Limerick IT)</li> <li>7 Tech/Construct Teaching (University of Limerick)</li> <li>8 Leisure Management (Dub. Inst. of Tech.)</li> <li>9 Hotel/Catering Mgt. (Galway-Mayo IT)</li> <li>10 Property Econ. (Valuation Surveying) (Dub. Inst. of Tech.)</li> <li>11 Agricultural Science (U. Coll. Dub.)</li> </ol>	<p>Construction and Leisure? Courses in ITs. Theta stays high for all values. But drops off more than other clusters. Male dominated (83%) Average points very low (340) Decreasing from 1 and 9 with a small spike at 10 (10%).</p>

	12	Computer and Software Engineering (Athlone IT)	
<b>Cluster 12</b> , label 136, $N_k = 2142$ , 4%		$\theta_k = (1.13, 1.19, 1.22, 1.17, 1.07, 0.98, 0.85, 0.73, 0.63, 0.45)$	Dublin dominated. Business courses. Language options in many. Courses more general than Cluster 7. Theta stays high for all values. Three times as many females as males. Average points very high (407) Uniform-ish between 1 and 9 with a spike at 10 (44%).
	1	Arts (U. Coll. Dub.)	
	2	Business Studies (Dub. City U.)	
	3	Commerce (U. Coll. Dub.)	
	4	"Business, Economic and Social Studies (BESS)" (Tri. Coll. Dub.)	
	5	Int'l Business and Languages French (Dub. Inst. of Tech.)	
	6	Business Studies (Dub. Inst. of Tech.)	
	7	Business and Legal Studies (U. Coll. Dub.)	
	8	Int'l Business and Languages German (Dub. Inst. of Tech.)	
	9	Arts (NUI - Maynooth)	
	10	European Business (French) (Dub. City U.)	
	11	Marketing (Dub. Inst. of Tech.)	
	12	Commerce/German (U. Coll. Dub.)	
13	Business/French (Tri. Coll. Dub.)		
<b>Cluster 13</b> , label 9, $N_k = 2065$ , 4%		$\theta_k = (1.36, 1.26, 1.19, 1.08, 0.97, 0.82, 0.64, 0.53, 0.42, 0.31)$	Dublin dominated. Arts courses some social and legal ones. Theta stays high for all values. Twice as many females as males. Average points very high (436) Uniform-ish between 1 and 9 with a spike at 10 (35%).
	1	Arts (U. Coll. Dub.)	
	2	Arts (NUI - Maynooth)	
	3	Psychology (Tri. Coll. Dub.)	
	4	English (Tri. Coll. Dub.)	
	5	Law (Tri. Coll. Dub.)	
	6	Arts (NUI - Galway)	
	7	Hist & Politics (Tri. Coll. Dub.)	
	8	Psychology (U. Coll. Dub.)	
	9	His. (Tri. Coll. Dub.)	
	10	Journalism (Dub. City U.)	
	11	English Literature/His. (Tri. Coll. Dub.)	
	12	Law (U. Coll. Dub.)	
13	Communications - Film & Broadcasting (Dub. Inst. of Tech.)		
<b>Cluster 14</b> , label 13, $N_k = 1452$ , 3%		$\theta_k = (1.63, 1.35, 0.99, 0.91, 0.75, 0.67, 0.57, 0.51, 0.46, 0.37)$	Dublin dominated. Hard to pin down. Very heterogeneous. Theta stays high for all values. Three times as many females as males. Average points very high (436) Uniform-ish between 1 and 9 but dips in the middle with a spike at 10 (40%).
	1	Arts (U. Coll. Dub.)	
	2	Physiotherapy (U. Coll. Dub.)	
	3	Physiotherapy (Tri. Coll. Dub.)	
	4	Law (U. Coll. Dub.)	
	5	Drumcondra (St. Patricks Drumcondra)	
	6	Science (U. Coll. Dub.)	
	7	Law (Tri. Coll. Dub.)	
8	Science (Tri. Coll. Dub.)		



	9 10 11 12	Clinical Speech (Tri. Coll. Dub.) Psychology (U. Coll. Dub.) Veterinary Med. (U. Coll. Dub.) Occupational Therapy (Tri. Coll. Dub.)	
<b>Cluster 15</b> , label 40, $N_k = 1422$ , 3%	1 2 3 4 5 6 7 8 9 10 11 12	$\theta_k = (4.39, 3.83, 3.48, 3.06, 2.18, 1.73, 1.28, 0.97, 0.88, 0.57)$ Drumcondra (St. Patricks Drumcondra) Mary Immaculate (Mary Immaculate Limerick) Froebel (Froebel College) Marino (Colaiste Mhuire Marino) Arts (NUI - Galway) Arts (NUI - Maynooth) Arts (U. Coll. Dub.) Arts (University of Limerick) Arts (U. Coll. Cork) Drum/B.A. Humanities (St. Patricks Drumcondra) Early Child Care and Education (Dub. Inst. of Tech.) Early Childhood Studies (U. Coll. Cork)	Teaching. Initially primary teaching and then Arts degrees which are a common route into secondary teaching. Theta stays high for all values. Extremely high initially. Ten times as many females as males. Average points middling (400) Slightly rising choices from 1 and 9 and with a spike at 10 (47%).
<b>Cluster 16</b> , label 5, $N_k = 1379$ , 3%	1 2 3 4 5 6 7 8 9 10 11 12	$\theta_k = (1.88, 1.87, 1.66, 1.43, 1.17, 0.92, 0.77, 0.55, 0.39, 0.27)$ Arts (U. Coll. Cork) Arts (NUI - Galway) Arts (NUI - Maynooth) Arts (University of Limerick) Arts (U. Coll. Dub.) Mary Immaculate (Mary Immaculate Limerick) Language and Cultural Studies - French (U. Coll. Cork) European Studies (U. Coll. Cork) Music (U. Coll. Cork) Language & Cultural Studies (University of Limerick) Music (NUI - Maynooth) European Studies (University of Limerick)	Arts followed by Music. Mainly outside Dublin. Theta stays high for all values. Four times as many females as males. Average points low-ish (384) Uniform from 1 and 9 and spike at 10 (28%).
<b>Cluster 17</b> , label 60, $N_k = 1238$ , 2%	1 2 3 4 5 6 7	$\theta_k = (3.91, 2.67, 2.12, 1.42, 1.11, 0.66, 0.54, 0.39, 0.36, 0.28)$ Arts (NUI - Galway) Commerce (NUI - Galway) Information Technology (NUI - Galway) Arts (Public & Social Policy) (NUI - Galway) Corporate Law (NUI - Galway) Arts (NUI - Maynooth) Bachelor of Civil Law (BCL) (NUI - Galway)	Galway cluster (also West of Ireland). More Arts than Science. Theta stays high for all values. Extremely high initially and quick drop. A little more females as males. Average points low-ish (383) Uniform from 1 and 9 and spike at 10 (27%).

	8 9 10 11 12	Computing Studies (NUI - Galway) Science (NUI - Galway) Arts (St. Angelas) (NUI - Galway) Arts (U. Coll. Dub.) Arts (University of Limerick)	
<b>Cluster 18</b> , label 17, $N_k = 992$ , 2%	1 2 3 4 5 6 7 8 9 10 11 12	$\theta_k = (3.02, 2.02, 1.49, 1.07, 0.71, 0.59, 0.35, 0.26, 0.26, 0.15)$ Design - Visual Communication (Dub. Inst. of Tech.) Communications - Film & Broadcasting (Dub. Inst. of Tech.) Drama & Theatre (Tri. Coll. Dub.) Fine Art (Dub. Inst. of Tech.) Photography (Dub. Inst. of Tech.) Design - Interior + Furniture (Dub. Inst. of Tech.) Arts (U. Coll. Dub.) Art/Design Teaching (National College of Art and Design) Multimedia (Dub. City U.) Drama Studies/English Literature (Tri. Coll. Dub.) Communications (Dub. City U.) Communications - Journalism (Dub. Inst. of Tech.)	Visual Arts Theta stays high for all values. Drops more than some other clusters. Twice as many females as males. Average points low-ish (430) Big spike at 1 (19%) and 10 (155) dipping in
<b>Cluster 19</b> , label 117, $N_k = 973$ , 2%	1 2 3 4 5 6 7 8 9 10 11 12	$\theta_k = (2.69, 2.57, 2.16, 1.92, 1.21, 0.68, 0.54, 0.35, 0.28, 0.20)$ Applied Computing (Waterford IT) Computer Applications (Cork IT) Software Development (Limerick IT) Computer Networking (IT Carlow) Software Dev & Comp Net (Cork IT) Construction Management (Waterford IT) Business studies (Waterford IT) Electronics (Waterford IT) Electronic Engineering (Waterford IT) Computing with Enterprise Studies (IT Tralee) Electronic Engineering (Cork IT) Computer Systems (University of Limerick)	Applied Computing. IT Colleges dominate. Theta stays high for all values. Not as high as other clusters. Three times as many males as females. Average points very low (331) Choices seem to be concentrated on 1-5 courses and 10.
<b>Cluster 20</b> , label 65, $N_k = 851$ , 2%	1 2 3 4 5 6	$\theta_k = (3.59, 3.04, 2.55, 1.49, 0.98, 0.79, 0.79, 0.60, 0.48, 0.39)$ PE Teaching (University of Limerick) Drumcondra (St. Patricks Drumcondra) Sports Science (University of Limerick) Sport Science and Health (Dub. City U.) Marino (Colaiste Mhuire Marino) Froebel (Froebel College)	Teaching and Sports. Theta stays high for all values. Twice as many females as males. Average points high (415) Choices seem spread between 1-9 and 10 (37%).

	<ul style="list-style-type: none"> <li>7 Mary Immaculate (Mary Immaculate Limerick)</li> <li>8 Leisure Management (Dub. Inst. of Tech.)</li> <li>9 Arts (U. Coll. Dub.)</li> <li>10 Physiotherapy (U. Coll. Dub.)</li> <li>11 Arts (NUI - Galway)</li> <li>12 Arts (NUI - Maynooth)</li> </ul>	
<p><b>Cluster 21</b>, label 0, <math>N_k = 645</math>, 1%</p>	<ul style="list-style-type: none"> <li>1 Arch. (Dub. Inst. of Tech.)</li> <li>2 Arch. (U. Coll. Dub.)</li> <li>3 Design - Visual Communication (Dub. Inst. of Tech.)</li> <li>4 Design - Interior + Furniture (Dub. Inst. of Tech.)</li> <li>5 Drumcondra/Gael (St. Patricks Drumcondra)</li> <li>6 Construction Econ &amp; Mgt (Qty. Survey) (Dub. Inst. of Tech.)</li> <li>7 Industrial Design (University of Limerick)</li> <li>8 Arts (NUI - Galway)</li> <li>9 Marino/Geel (Colaiste Mhuire Marino)</li> <li>10 Arts (U. Coll. Dub.)</li> <li>11 Mary Immaculate/Gael (Mary Immaculate Limerick)</li> <li>12 Photography (Dub. Inst. of Tech.)</li> </ul>	<p><math>\theta_k = (3.19, 2.36, 0.94, 0.87, 0.73, 0.47, 0.34, 0.30, 0.24, 0.21)</math></p> <p>Architecture, design initially. Then a mix of education type courses. Theta stays high for all values but tails off quite quickly after 4. Gender balanced Average points high (412) Choices seem spread between 1-2 (high, 3-9 (lower) and 10 (23%).</p>
<p><b>Cluster 22</b>, label 141, <math>N_k = 641</math>, 1%</p>	<ul style="list-style-type: none"> <li>1 Marketing (Portobello College)</li> <li>2 Int'l Tourism (American College)</li> <li>3 Business Studies (Portobello College)</li> <li>4 Behav Science (Psychology) (American College)</li> <li>5 Business Studies (Griffith College Dublin)</li> <li>6 Journalism and Media Comms (Griffith College Dublin)</li> <li>7 Hotel/Catering Mgt. (Galway-Mayo IT)</li> <li>8 Bus Studies (Marketing) (Dublin Business School)</li> <li>9 Computer Science (Griffith College Dublin)</li> <li>10 Computer Networking (IT Carlow)</li> <li>11 Human Resource Management (Portobello College)</li> <li>12 Information &amp; Comm. Tech. (Tri. Coll. Dub.)</li> </ul>	<p><math>\theta_k = (1.58, 1.60, 1.41, 1.05, 0.60, 0.34, 0.26, 0.22, 0.19, 0.08)</math></p> <p>Small private college courses. Mainly business. Theta starts moderately high, but tails off. Gender balanced Average points very low (280) Choices seems to decrease from 1-8 and rise from 9-10.</p>
<p><b>Cluster 23</b>, label 55, <math>N_k = 543</math>, 1%</p>	<ul style="list-style-type: none"> <li>1 Design - Visual Communication (Dub. Inst. of Tech.)</li> <li>2 Fine Art (Dub. Inst. of Tech.)</li> <li>3 Art/Design Teaching (National College of Art and Design)</li> <li>4 Design - Interior + Furniture (Dub. Inst. of Tech.)</li> <li>5 Photography (Dub. Inst. of Tech.)</li> </ul>	<p><math>\theta_k = (4.04, 4.00, 3.20, 0.22, 0.02, 0.01, 0.00, 0.00, 0.00, 0.00)</math></p> <p>Art and Design. Theta starts very high, but drops off from position 4 onwards. Twice as many females as males. Average points high (410) Choices seems to drop rapidly after 3 choices. Most choose 1-3.</p>

	6	Industrial Design (University of Limerick)	
<b>Cluster 24</b> , label 116, $N_k = 473$ , 1%		$\theta_k = (1.90, 1.74, 1.25, 0.83, 0.83, 0.38, 0.41, 0.28, 0.27, 0.14)$	
	1	Arts (U. Coll. Dub.)	Teaching and Religion. Theta starts moderately high, but drops off by position 10. Nearly twice as many females as males. Average points low (342) Choices seems to vary between 1-9 and a peak at 10 (16%) but not very strong.
	2	Arts (NUI - Maynooth)	
	3	Theology and Arts (St. Patricks (Pontifical) - Maynooth)	
	4	Theology/Philosophy (All Hallows)	
	5	"Eng., Med., and Cult. Stud." (Dun Lao. Inst of Art & Design)	
	6	BA Phil/Theology (Milltown Institute)	
	7	BA Theology (Milltown Institute)	
	8	Music (Dub. Inst. of Tech.)	
	9	Arts (NUI - Galway)	
	10	BA Philosophy (Milltown Institute)	
	11	Biblical Theology (Tri. Coll. Dub.)	
12	Arts (Psychology) (LSB College)		
<b>Cluster 25</b> , label 113, $N_k = 446$ , 1%		$\theta_k = (4.22, 3.77, 3.92, 2.91, 0.30, 0.16, 0.07, 0.04, 0.02, 0.02)$	
	1	Arts (NUI - Galway)	Arts and History Theta starts very high, but drops off by position 5. Nearly twice as many females as males. Average points low-ish (375) Choices seems to vary but tail off after 4.
	2	Arts (U. Coll. Cork)	
	3	Arts (NUI - Maynooth)	
	4	Arts (U. Coll. Dub.)	
	5	Arts (University of Limerick)	
	6	Theology and Arts (St. Patricks (Pontifical) - Maynooth)	
	7	Arts (St. Angelas) (NUI - Galway)	
8	Psychology (NUI - Maynooth)		
<b>Cluster 26</b> , label 84, $N_k = 438$ , 1%		$\theta_k = (3.66, 4.14, 2.25, 0.58, 0.14, 0.04, 0.04, 0.01, 0.02, 0.01)$	
	1	Hospitality (Hotel/Catering) Management (Dub. Inst. of Tech.)	Hospitality and Sports. Theta starts very high, but drops off by position 4 and keeps decreasing. Nearly three times as many females as males. Average points very low (310) Choices seems to vary but tail off after 3.
	2	Hotel/Catering Mgt. (Galway-Mayo IT)	
	3	Tourism Marketing (Dub. Inst. of Tech.)	
	4	Culinary Arts (Dub. Inst. of Tech.)	
	5	Leisure Management (Dub. Inst. of Tech.)	
	6	Hospitality Management (Waterford IT)	
7	Commerce ( + Dip in Int'l Hotel M) (Shan. Coll. of Hotel Mgt.)		
<b>Cluster 27</b> , label 191, $N_k = 316$ , 1%		$\theta_k = (3.77, 3.76, 3.04, 0.39, 0.10, 0.05, 0.03, 0.02, 0.01, 0.08)$	
	1	Business studies (Waterford IT)	Business. Waterford dominated. Theta starts very high, but drops off by position 4 and keeps decreasing. Twice times as many females as males. Average points quite low (332) Choices seems to vary with a strong mode at 2 (33%) very few chose more than 5 courses.
	2	Adminstration (Waterford IT)	
	3	Business studies/French (Waterford IT)	
	4	Accounting (Waterford IT)	
5	Applied Computing (Waterford IT)		

	6	Hospitality Management (Waterford IT)	
<b>Cluster 28</b> , label 182, $N_k = 308$ , 1%		$\theta_k = (2.31, 0.52, 0.40, 0.27, 0.21, 0.12, 0.06, 0.06, 0.04, 0.03)$	Business. Waterford dominated. Theta starts very high, but drops off by position 2 and keeps decreasing. Pretty balanced in gender. Average points quite low (336) Choices seems to vary with a strong mode at 1 (32%) and slowly decreasing from 2 onwards.
	1	Computing with Data Communications (Letterkenny IT)	
	2	Hotel/Catering Mgt. (Galway-Mayo IT)	
	3	Equine Science (University of Limerick)	
	4	Photography (Dub. Inst. of Tech.)	
	5	Arts (NUI - Maynooth)	
	6	Gno agus Cumarsald (Galway-Mayo IT)	
	7	Int'l Business with French (IT Carlow)	
	8	Art/Design Teaching (National College of Art and Design)	
<b>Cluster 29</b> , label 27, $N_k = 199$ , 0%		$\theta_k = (4.21, 4.46, 3.76, 0.15, 0.09, 0.01, 0.02, 0.00, 0.00, 0.00)$	Child care and social studies. Theta starts very high, but drops off by position 4 and gets very small. 98% Female Average points low-ish (368) Choices seems to vary with a strong mode at 3 (31%) and most picking 1-4.
	1	Early Child Care and Education (Dub. Inst. of Tech.)	
	2	Social Care (Dub. Inst. of Tech.)	
	3	Early Childhood Studies (U. Coll. Cork)	
	4	Hospitality (Hotel/Catering) Management (Dub. Inst. of Tech.)	
	5	Social Work (Tri. Coll. Dub.)	
	6	Tourism Marketing (Dub. Inst. of Tech.)	
<b>Cluster 30</b> , label 120, $N_k = 119$ , 0%		$\theta_k = (4.32, 0.05, 0.02, 0.02, 0.00, 0.01, 0.00, 0.01, 0.01, 0.72)$	UCD Evening Arts degree. Theta starts very high, but drops off immediately. Anomalous value at 10 Gender balanced Average points low-ish (360) Very strong mode at 1 (91%)
	1	Arts/Evening modular (U. Coll. Dub.)	
	2	Computing with Data Communications (Letterkenny IT)	
	3	Arts (U. Coll. Dub.)	
<b>Cluster 31</b> , label 18, $N_k = 53$ , 0%		$\theta_k = (3.60, 3.44, 1.86, 0.08, 0.11, 1.54, 0.01, 0.00, 0.00, 0.00)$	DIT Applied Engineering courses. Theta starts very high, but drops off after 4. Anomalous value at 5 (consistent choices by a small number). Male dominated (92%) Average points very low (303) Most people pick 3 or fewer courses.
	1	Engineering (Dub. Inst. of Tech.)	
	2	Electrical/Electronic Engineering (Dub. Inst. of Tech.)	
	3	Construction Econ & Mgt (Qty. Survey) (Dub. Inst. of Tech.)	
	4	Transport Technology (Dub. Inst. of Tech.)	
	5	Computer Engineering (Dub. Inst. of Tech.)	
<b>Cluster 32</b> , label 242, $N_k = 39$ , 0%		$\theta_k = (3.50, 3.01, 1.87, 0.21, 0.11, 0.03, 0.03, 0.00, 0.00, 0.00)$	Athlone IT Courses. All applied engineering. Later courses all in other ITs. Theta starts very high, but drops off after 4. Anomalous value at 5 (consistent choices by a small number). Male dominated (82%) Average points very low (284) Choices decrease from 1 to 7.
	1	Computer and Software Engineering (Athlone IT)	
	2	Polymer Engineering (Athlone IT)	
	3	Polymer Technology (Athlone IT)	
	4	Computer Networking (IT Carlow)	
	5	Accounting & Finance (Dundalk IT)	

	6	Construction Management (Galway-Mayo IT)	
<b>Cluster 33</b> , label 10, $N_k = 9$ , 0%		$\theta_k = (2.22, 2.18, 1.86, 0.02, 0.01, 0.02, 0.01, 0.00, 0.00, 0.00)$	Home economics teaching. Theta starts very high, but drops off completely after 3. All female Average points high (418) Choices 2 or 3.
	1	Home Econ & Biology (St. Angelas - Sligo)	
	2	Home Econ & Catechetics (St. Angelas - Sligo)	
	3	Home Econ. (St. Catherines - Sion Hill)	
	4	English Literature/Music (Tri. Coll. Dub.)	
	5	Food Process Engineering (U. Coll. Cork)	

Table 1: Clustering generated by a Dirichlet process mixture of generalized Mallows' models.

### 3 Table 2: Results with Finite Mixture of Infinite Generalized Mallows' Models.

Cluster number, $N_k$	Rank	Central ranking $\sigma_k$ , dispersions $\theta_k$
<b>Cluster 1</b> , label 3, $N_k = 4483$ , 8%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (NUI - Maynooth)
	2	Arts (U. Coll. Dub.)
	3	Arts (U. Coll. Cork)
	4	Arts (University of Limerick)
	5	Social Care (Dub. Inst. of Tech.)
	6	Qty. Surveying (Limerick IT)
	7	Mary Immaculate (Mary Immaculate Limerick)
	8	Early Child Care and Education (Dub. Inst. of Tech.)
	9	Arts (NUI - Galway)
10	Building Management (Limerick IT)	
<b>Cluster 2</b> , label 0, $N_k = 3815$ , 7%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01)$
	1	Arts (U. Coll. Cork)
	2	Arts (NUI - Galway)
	3	Drumcondra (St. Patricks Drumcondra)
	4	Arts (NUI - Maynooth)
	5	Froebel (Froebel College)
	6	Marino (Colaiste Mhuire Marino)
	7	Arts (U. Coll. Dub.)
	8	Mary Immaculate (Mary Immaculate Limerick)
	9	Early Childhood Studies (U. Coll. Cork)
10	Early Child Care and Education (Dub. Inst. of Tech.)	
<b>Cluster 3</b> , label 13, $N_k = 3786$ , 7%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.02, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (NUI - Galway)
	2	Arts (U. Coll. Dub.)
	3	Commerce (NUI - Galway)
	4	Arts (U. Coll. Cork)
	5	Business Studies (Dub. City U.)
	6	Business Studies (Dub. Inst. of Tech.)
	7	Science (U. Coll. Dub.)
	8	Business Studies (University of Limerick)
	9	Science (Tri. Coll. Dub.)
10	Engineering (Tri. Coll. Dub.)	
		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01)$

**Cluster 4**, label 6,  
 $N_k = 3470$ , 6%

	<ol style="list-style-type: none"> <li>1 Computer Applications (Cork IT)</li> <li>2 Software Dev &amp; Comp Net (Cork IT)</li> <li>3 Business Studies (Dub. City U.)</li> <li>4 Business Studies (Dub. Inst. of Tech.)</li> <li>5 Software Development (Limerick IT)</li> <li>6 Computer Science (U. Coll. Cork)</li> <li>7 Computer Systems (University of Limerick)</li> <li>8 Commerce (U. Coll. Dub.)</li> <li>9 Marketing (Dub. Inst. of Tech.)</li> <li>10 Admin &amp; Marketing (Dub. Inst. of Tech.)</li> </ol>
<b>Cluster 5</b> , label 10, $N_k = 3138$ , 6%	$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01)$ <ol style="list-style-type: none"> <li>1 Arts (U. Coll. Dub.)</li> <li>2 Business Studies (Dub. Inst. of Tech.)</li> <li>3 Computer Applications (Dub. City U.)</li> <li>4 Business Studies (Dub. City U.)</li> <li>5 Tourism Marketing (Dub. Inst. of Tech.)</li> <li>6 Commerce (U. Coll. Dub.)</li> <li>7 Admin &amp; Marketing (Dub. Inst. of Tech.)</li> <li>8 Information &amp; Comm. Tech. (Tri. Coll. Dub.)</li> <li>9 Computer Science (U. Coll. Dub.)</li> <li>10 Science (U. Coll. Dub.)</li> </ol>
<b>Cluster 6</b> , label 7, $N_k = 3121$ , 6%	$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$ <ol style="list-style-type: none"> <li>1 Arts (U. Coll. Dub.)</li> <li>2 Marketing (Dub. Inst. of Tech.)</li> <li>3 Communications - Film &amp; Broadcasting (Dub. Inst. of Tech.)</li> <li>4 Business Studies (Dub. Inst. of Tech.)</li> <li>5 Design - Visual Communication (Dub. Inst. of Tech.)</li> <li>6 Admin &amp; Marketing (Dub. Inst. of Tech.)</li> <li>7 Law (U. Coll. Dub.)</li> <li>8 Business and Legal Studies (U. Coll. Dub.)</li> <li>9 Journalism (Dub. City U.)</li> <li>10 Property Econ. (Valuation Surveying) (Dub. Inst. of Tech.)</li> </ol>
<b>Cluster 7</b> , label 1, $N_k = 2914$ , 5%	$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01)$ <ol style="list-style-type: none"> <li>1 Arts (NUI - Galway)</li> <li>2 Arts (U. Coll. Cork)</li> <li>3 Arts (U. Coll. Dub.)</li> <li>4 Arts (NUI - Maynooth)</li> <li>5 Computer Science (U. Coll. Cork)</li> </ol>



	6	Computer Applications (Cork IT)
	7	Software Dev & Comp Net (Cork IT)
	8	Mary Immaculate (Mary Immaculate Limerick)
	9	Arts (University of Limerick)
	10	Science (NUI - Galway)
<b>Cluster 8</b> , label 18, $N_k = 2872$ , 5%		$\theta_k = (0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (U. Coll. Dub.)
	2	Arts (NUI - Galway)
	3	Arts (NUI - Maynooth)
	4	Social Care (Dub. Inst. of Tech.)
	5	Psychology (Tri. Coll. Dub.)
	6	Social Work (Tri. Coll. Dub.)
	7	Psychology (U. Coll. Dub.)
	8	Arts (U. Coll. Cork)
	9	Psychology (NUI - Maynooth)
10	Computer Applications (Dub. City U.)	
<b>Cluster 9</b> , label 12, $N_k = 2649$ , 5%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01)$
	1	Computer Applications (Dub. City U.)
	2	Business studies (Waterford IT)
	3	Commerce (U. Coll. Cork)
	4	Arts (U. Coll. Cork)
	5	Business Studies (University of Limerick)
	6	Computer Science (U. Coll. Dub.)
	7	Applied Sciences/Computing (Dub. Inst. of Tech.)
	8	Computer Science (NUI - Maynooth)
	9	Computer Engineering (Dub. Inst. of Tech.)
10	Business Studies (Dub. City U.)	
<b>Cluster 10</b> , label 5, $N_k = 2539$ , 5%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Commerce (U. Coll. Dub.)
	2	"Business, Economic and Social Studies (BESS)" (Tri. Coll. Dub.)
	3	Business and Legal Studies (U. Coll. Dub.)
	4	Arts (U. Coll. Dub.)
	5	Commerce (NUI - Galway)
	6	Accounting and Finance (Dub. City U.)
	7	Business Studies (Dub. City U.)
	8	Business Studies (Dub. Inst. of Tech.)
9	Finance (NUI - Maynooth)	

<b>Cluster 11</b> , label 9, $N_k = 2354$ , 4%	10	Arts (NUI - Galway)
	$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$	
	1	Leisure Management (Dub. Inst. of Tech.)
	2	Biological and Chemical Sciences (U. Coll. Cork)
	3	Science (U. Coll. Dub.)
	4	Science (NUI - Galway)
	5	Arts (U. Coll. Dub.)
	6	Hospitality (Hotel/Catering) Management (Dub. Inst. of Tech.)
	7	Social Care (Dub. Inst. of Tech.)
	8	Pharmacy (Tri. Coll. Dub.)
	9	Early Child Care and Education (Dub. Inst. of Tech.)
10	Marketing (Dub. Inst. of Tech.)	
<b>Cluster 12</b> , label 17, $N_k = 2301$ , 4%	$\theta_k = (0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$	
	1	Arts (U. Coll. Cork)
	2	Arts (U. Coll. Dub.)
	3	Social Science (U. Coll. Cork)
	4	Early Childhood Studies (U. Coll. Cork)
	5	Computer Science (U. Coll. Cork)
	6	Business studies (Waterford IT)
	7	Commerce (U. Coll. Dub.)
	8	Law (U. Coll. Cork)
	9	Business Info. Systems Development (Dub. Inst. of Tech.)
	10	"Business, Economic and Social Studies (BESS)" (Tri. Coll. Dub.)
<b>Cluster 13</b> , label 2, $N_k = 2286$ , 4%	$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01)$	
	1	Business Studies (University of Limerick)
	2	Information Technology (University of Limerick)
	3	Hotel/Catering Mgt. (Galway-Mayo IT)
	4	Computer Systems (University of Limerick)
	5	Commerce (U. Coll. Cork)
	6	Software Development (Limerick IT)
	7	Commerce (U. Coll. Dub.)
	8	Commerce (NUI - Galway)
	9	Business Studies (Dub. City U.)
	10	Business Studies (Dub. Inst. of Tech.)
<b>Cluster 14</b> , label 15, $N_k = 2252$ , 4%	$\theta_k = (0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$	
	1	Arts (U. Coll. Dub.)
	2	Arts (NUI - Galway)

	3	Science (U. Coll. Dub.)
	4	Science (Tri. Coll. Dub.)
	5	Arts (NUI - Maynooth)
	6	Law (Tri. Coll. Dub.)
	7	Law (U. Coll. Dub.)
	8	Science (NUI - Galway)
	9	Science (NUI - Maynooth)
	10	Business Studies (University of Limerick)
<b>Cluster 15</b> , label 11, $N_k = 2176$ , 4%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Business Studies (Dub. City U.)
	2	Business Studies (Dub. Inst. of Tech.)
	3	Med. (U. Coll. Dub.)
	4	Med. (NUI - Galway)
	5	Engineering (U. Coll. Dub.)
	6	Arts (U. Coll. Cork)
	7	Engineering (Tri. Coll. Dub.)
	8	Engineering (Dub. Inst. of Tech.)
	9	Information & Comm. Tech. (Tri. Coll. Dub.)
10	Commerce (U. Coll. Dub.)	
<b>Cluster 16</b> , label 19, $N_k = 2119$ , 4%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (NUI - Maynooth)
	2	Arts (U. Coll. Dub.)
	3	Arts (NUI - Galway)
	4	Psychology (Tri. Coll. Dub.)
	5	Psychology (U. Coll. Dub.)
	6	Psychology (NUI - Maynooth)
	7	Engineering (U. Coll. Dub.)
	8	Med. (U. Coll. Dub.)
	9	Science (U. Coll. Dub.)
10	Engineering (Tri. Coll. Dub.)	
<b>Cluster 17</b> , label 4, $N_k = 2048$ , 4%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (U. Coll. Dub.)
	2	Leisure Management (Dub. Inst. of Tech.)
	3	Journalism (Dub. City U.)
	4	Communications - Journalism (Dub. Inst. of Tech.)
	5	Sport Science and Health (Dub. City U.)
	6	Communications (Dub. City U.)
7	Arts (NUI - Maynooth)	

	8	Marketing (Dub. Inst. of Tech.)
	9	Property Econ. (Valuation Surveying) (Dub. Inst. of Tech.)
	10	Construction Econ & Mgt (Qty. Survey) (Dub. Inst. of Tech.)
<b>Cluster 18</b> , label 8, $N_k = 1986$ , 4%		$\theta_k = (0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (NUI - Galway)
	2	Arts (NUI - Maynooth)
	3	Tourism Marketing (Dub. Inst. of Tech.)
	4	Marketing (Dub. Inst. of Tech.)
	5	Arts (University of Limerick)
	6	Engineering (Dub. Inst. of Tech.)
	7	Business Studies (University of Limerick)
	8	Hospitality (Hotel/Catering) Management (Dub. Inst. of Tech.)
	9	Electrical/Electronic Engineering (Dub. Inst. of Tech.)
10	Photography (Dub. Inst. of Tech.)	
<b>Cluster 19</b> , label 16, $N_k = 1789$ , 3%		$\theta_k = (0.02, 0.02, 0.02, 0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Med. (Tri. Coll. Dub.)
	2	Med. (U. Coll. Dub.)
	3	Arts (U. Coll. Dub.)
	4	Arts (NUI - Maynooth)
	5	Med. (NUI - Galway)
	6	Med. (U. Coll. Cork)
	7	Med. (Roy. Coll. of Surg.)
	8	Physiotherapy (Tri. Coll. Dub.)
	9	Science (Tri. Coll. Dub.)
10	Science (U. Coll. Dub.)	
<b>Cluster 20</b> , label 14, $N_k = 1659$ , 3%		$\theta_k = (0.02, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01, 0.01)$
	1	Arts (U. Coll. Dub.)
	2	Arts (U. Coll. Cork)
	3	Arts (NUI - Maynooth)
	4	Commerce (U. Coll. Dub.)
	5	Science (U. Coll. Dub.)
	6	Science (NUI - Galway)
	7	Business Studies (Dub. City U.)
	8	Business Studies (Dub. Inst. of Tech.)
	9	Commerce (NUI - Galway)
10	Arts (NUI - Galway)	

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Table 2: Clustering generated by a finite mixture of infinite generalized Mallows' models.