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<< IntU`
```

Package IntU version 0.1.25 (last modification: 14/09/2011).

Main functionality

? IntegrateUnitaryHaar

IntegrateUnitaryHaar[*integrand* ,{ *var* , *dim* }] gives the definite
   integral on unitary group with respect to Haar, accepting the following arguments:
– *integrand* – polynomial type expression of variable *var* with indices placed as
   subscripts, can contain any other symbolic expression of other variables,
– *var* – symbol of variable for integration,
– *dim* – the dimension of a unitary group, must be a positive integer.
IntegrateUnitaryHaar[*f* ,{ *u* , *d1* },{ *v* , *d2* } ...] gives multiple integral.

? IntegrateUnitaryHaarIndices

IntegrateUnitaryHaarIndices{ *I1* , *J1* , *I2* , *J2* }, *dim*] gives an the definite integral
   on unitary group with respect to Haar for given indices. see [Collins & Śniady 2006].

Weingarten function

? Weingarten

Weingarten[*type* , *dim*] – returns the value of *Weingarten*
   function defined in [Collins & Śniady 2006] accepts the following arguments
– *type* – an integer partition which corresponds to cycle type of permutation,
– *dim* – the dimension of a unitary group, must be a positive integer.

? CharacterSymmetricGroup

CharacterSymmetricGroup[*part* , *type*] – gives the character of the symmetric group $\chi^{part}(type)$
Parameter *type* is optional. The default value is set to a trivial partition and in this case the function
   returns the dimension of the irreducible representation of symmetric group indexed by *part* ,
If *type* is specified the value of the character is calculated by Murnaghan–Nakayama
   rule using *MNInner* algorithm provided in [Bernstein 2004].

? SchurPolynomialAt1

SchurPolynomialAt1[*part* , *dim*] – returns the value of Schur polynomial s$_{part}$ at *d* –dimensional point
   $(1,1,...,1)$, i.e. the dimension of irreducible representation of *U*(*dim*) corresponding to *part* .

Helper functions

? PermutationTypePartition

PermutationTypePartition[*perm*] – gives the partition which represents the cycle type of the permutation *perm*.

? MultinomialBeta

MultinomialBeta[*p*] – gives for *d* –dimensional vector of non negative

numbers p_1, p_2, …, p_d the value of multinomial Beta function defined as $\dfrac{\prod \Gamma(p_i)}{\Gamma(\sum p_i)}$.

? ConjugatePartition

ConjugatePartition[*part*] – gives a conjugate of a partition *part*.

? CardinalityConjugacyClassPartition

CardinalityConjugacyClassPartition[*part*] – gives a cardinality of conjugacy class for permutation with cycle type given by partition *part*.

? BinaryPartition

BinaryPartition[*part*] – gives a binary representation of a partition *part*. This function is needed for the implementation of *MNInner* algorithm in function **CharacterSymmetricGroup**.

References

[Bernstein 2004] D. Bernstein, The computational complexity of rules for the character table of s_n, Journal of Symbolic Computation, Volume 37, Issue 6 (2004), pp. 727-748.

[Collins & Sniady 2006] B. Collins and P. Sniady, Integration with Respect to the Haar Measure on Unitary, Orthogonal and Symplectic Group, Communications in Mathematical Physics, Volume 264, Number 3 (2006), pp. 773-795.