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<< IntU`
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Package IntU version 0.2.0 (last modification: 19/09/2011).
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Main functionality

? IntegrateUnitaryHaar

IntegrateUnitaryHaar[*integrand*,{*var*,*dim*}] gives the definite integral on unitary group with respect to the Haar measure, 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 a definite integral on unitary group with respect to the Haar measure for given indices. see [Collins & Śniady 2006].

Weingarten function

? Weingarten

Weingarten[*type*,*dim*] – returns the value of *Weingarten* function defined in [Collins & Śniady 2006] and accepts the following arguments:
– *type* – an integer partition which corresponds to the 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 the 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 $p_1, p_2, \ldots, p_d$ the value of multinomial Beta function defined as $\frac{\prod \Gamma(p_i)}{\Gamma(\sum p_i)}$.

? ConjugatePartition

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

? CardinalityConjugacyClassPartition

CardinalityConjugacyClassPartition[*part*] – gives a cardinality of conjugacy class for permutation with the cycle type given by a 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 & Śniady 2006] B. Collins and P. Śniady, *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.